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THE Supreme Judicial Court of Massachusetts lays down the dictum that there is no absolute or fixed speed limit at which automobiles may be operated in that state. The court decides that if a jury finds that the rate of speed was reasonable and proper, having regard to traffic, use of the way and safety of the public, it should find for a defendant, no matter at what rate of speed he ran his machine. The decision was in the case of the Commonwealth vs. Cassidy. We notice it here merely to observe that the court by this common sense view has punctured a multitude of illogical laws, by-laws and decisions—provided the men who have made these by-laws will heed the court's deliverance. We call it a common sense view. It is common sense because it is unavoidable. Railway men take only a secondary interest in speed limits on highways, but it is, perhaps, their duty to their lay friends who now and then ask advice on the subject of speed limits, to demolish the widely prevalent view that speeds can be regulated by a statutory rule naming rates per mile. The state or municipality has a choice of only two methods: (1) Very severe punishment for every person who drives at dangerous speed, or (2) a policeman posted at every street corner and (where necessary) at frequent intervals elsewhere. The first method is necessarily harsh, and to be effective would have to punish many innocent with the guilty. The second is the method which the railways use to prevent collisions; the signalman has absolute authority over enginemen. On the streets this would be very costly.

THE letter from Mr. Melcher, in another column, on the arbitration of railway labor disputes is an expression of the views of a railway officer who has had as much experience in handling railway labor matters in recent years as has any other officer in the country. Mr. Melcher does not accept Mr. Delano's plan for the solution of the problem of devising means for satisfactorily settling such disputes; namely, the establishment of a permanent court of arbitration. He suggests that after such a court has rendered a few decisions both employers and employees would know its general attitude and one or the other would be indisposed to submit further cases of it. Doubtless there is a good deal in this view. Shippers and railway men know the general attitude of most of the members of the Interstate Commerce Commission and can predict with substantial accuracy before the hearings on important cases begin how most of them will stand when the time comes to decide the cases. Mr. Melcher, like all others who have written on the subject, agrees, however, that the Erdmann act as it now stands does not work satisfactorily, and Mr. Delano's suggestion that the proposed court of arbitration be composed of an even number of members would insure every case being decided by a majority of at leats two, which would tend to strengthen its opinions in the eyes of the public and perhaps in the eyes of the parties. The fact that all who have contributed discussions on the subject have agreed that the Erdmann act does not produce satisfactory results shows Mr. Delano's wisdom in starting the discussion, and indicates clearly that some concerted action should be taken to secure legislation that will remedy the defects of that law.

IT has been repeatedly asserted of late years that New England has reached her zenith as productive territory for railway business. The statement has had in it a minor element of truth as expressing the fact of growing competition of the cotton factories of the South and of rivalry of new western factories established because of nearness to western markets and centers of population. But the census returns now coming in and covering the last half decade bring out the striking fact that New England factory losses have been relative, and very far from absolute. They have only lost the indefinite gain which might have accrued but for western and southern rivalry, where their positive gains have been very large indeed. Thus the factory products of the state of Massachusetts have risen 33 per cent.

during the five years; and, taking the three largest cities in Connecticut, New Haven rises about 28 per cent., Hartford about 57 per cent., and Bridgeport about 48 per cent. The total factory product of Massachusetts and the three cities represents a value of approximately $1,650,000,000, on a gain of about 32 per cent. over five years ago. While some allowance must be made for a rise in value of factory products during the last five years, due to economic causes, it does not greatly impair the returns, the rise of manufactured goods being far below the lift in food products and, in some cases, showing an actual decrease. Moreover, one finds in Massachusetts, for example, an increase of 9 per cent. in the number of factories, and of 20 per cent. in the number of wage earners. The New Haven and Boston & Maine systems last year carried 12 per cent. of their total freightage as factory products and high-class freight, and at the higher rates which that class signifies. On the passenger side of the business there is the steady increase of population of the New England cities, which means directly increasing travel, as distinguished somewhat sharply from the people of the farm. The conclusion seems clear that, while New England may not compare as a railway feeder in the pace of her growth with a newly settled railway region of the West, her advance continues to be rapid. Her transportation problem ahead is to dispel farm stagnation and give the rural committees a start in the same progressive direction as that of the factory cities and towns.

THE HADLEY SECURITIES COMMISSION.

IN ENGLAND it is the rule, when an important question involving the general welfare of the community is before the public for discussion and possible legislation, to appoint a parliamentary committee of men of reputation and legislative or expert experience to make an exhaustive report on the subject. In this country generally the legislation comes first and the discussion afterward; and generally the discussion takes on a political character. In both the Republican and the Democratic party platforms in 1908 there was a paragraph advocating some legislation which should control the issuance of securities by railway companies. In the Mann-Elkins amendment to the act to regulate commerce provision was made for the appointment by President Taft of a commission of five men to make a thorough study of the advisability of further legislation on this subject, and to recommend what form this legislation should take. President Taft appointed President Hadley, of Yale University, as chairman of the committee, and President Taft and President Hadley together selected the other four members of the commission. They were Frederick Strauss, vice-chairman; B. H. Meyer, F. N. Judson, W. L. Fisher Fisher and W. E. S. Griswold, secretary.

A consideration of the personnel of the commission is of great importance. The breadth of the commission's inquiry, and the highly technical and delicate nature of some of the subjects to be dealt with made it imperative that the commission should combine to an unusual degree practical technical knowledge with scholarship. President Hadley's name, of course, needs simply to be mentioned to explain his contribution toward the commission. Frederick Strauss is a member of the banking firm of J. & W. Seligman & Company, New York. He, as a practical banker, has had actual experience in the technical details of financing on a large scale the issue of securities for railways, and for other corporations; he brought to the commission not only technical knowledge but a broad understanding of international money market conditions. Mr. Meyer was for a number of years chairman of the Wisconsin Railway Commission, and before that was a professor in Wisconsin University, and a student of railway and industrial economics. Mr. Fisher and Mr. Judson are both lawyers, who have had to deal with cases before the Interstate Commerce Commission, as well as cases in which the orders of the state commissions and interstate commission have been attacked before the courts. Mr. Fisher was one of the attorneys representing the shippers at the rate hearing.

The list of names of those called to testify before this commission makes an impressive array of legal, economic and financial experts. The commission held public hearings, at which the answers of the various witnesses were made a part of the record of the commission, and also held a great number of informal conferences, at which various men were asked to be present and to discuss in an entirely informal and frank way the questions that the commission undertook to study. It is worth while mentioning a few of the names of the witnesses, because possibly this is the best way to convey some idea of the breadth of the inquiry: Commissioner Clements, of the Interstate Commerce Commission; Commissioner Hall, of the Massachusetts Railway Commission; Jacob H. Shiff, of the banking firm of Kuhn, Loeb & Co.; Robert Lovett, president of the Union and Southern Pacific; Paul D. Cravath, corporation lawyer; W. M. Acworth, English economist; W. D. Williams, of the Texas Railway Commission; E. E. Williamson, who represented the shippers in their opposition to the rate advances; and Louis D. Brandeis. These are a few of the men who expressed their opinions on the subject of the regulation of the issuance of securities of railway companies. The securities commission was not represented by counsel, the various members of the commission questioning the men who appeared before them; the inquiries, therefore, took rather the nature of general discussion than of formal question and answer. There was nothing like a cross-examination of any of the witnesses.

Naturally from the great variety of types of witnesses there was a very great diversity of opinion, as to whether regulation was desirable at all; but there was a rather remarkable agreement between nearly all of the witnesses as to the desire on the part of the people to have some sort, at least, of either regulation or publicity. The reasons for this demand on the part of the people were quite plainly suggested by the general trend of the commission's inquiry. In some cases the commission wrote letters to men who were to appear before the commission, asking them a set of questions. These questions were not always worded exactly the same, but taken in connection with the questions that were asked at the hearings they indicate quite clearly the general scope of the work.

In the discussion of broad economic subjects the different phases of various questions were discussed together, and often in such a way as to superficially confuse the points that the commission had under consideration. It has seemed best, therefore, in commenting on the work of the commission, and in describing some of the points brought out by the men who testified, to treat these points separately. In another column in this issue, one of these general subjects is discussed and commented on. All that we are attempting to do here is to outline the scope of the commission's work and especially to try and show what underlay the demand for the appointment of the Hadley commission. Anything further would be simply a guess as to what the report of the commission would probably contain.

In following the testimony of the witnesses, it is important to bear in mind that the commission has two clearly differentiated objects in view in its inquiry. These objects are to decide: first, whether certain *laws* shall be passed; and, second, whether the power of regulating the issue of securities shall be *delegated* by congress to some commission, and how far congress shall restrict such commission as to what it shall do and how far it shall be left to its own judgment. This distinction between the two objects of the inquiry must be kept constantly in mind, as will be shown by the abstracts of the testimony, because many of the witnesses did *not* keep this distinction clearly in mind. It is quite conceivable that the commission may recommend some legislation which would put added restrictions on the issuance of railway securities, but would make the enforcement

of such restrictions dependent on action by the courts, and not recommend that congress delegate any of its discretionary power to a commission. On the other hand, it is conceivable that the commission may recommend that congress appoint a permanent committee whose duties will be so loosely defined that in practice it will have the widest discretion as to how far to go in the regulation of issues of stocks and bonds.

Let us now see what led to demand for a change in the present laws. As mentioned elsewhere, one of the important questions taken up by the commission is that of the legality of federal regulation: first, if it is to exclude a state regulation; and, second, if it is to be superimposed on state regulation; or whether it is better to leave the regulation of securities to state commissions entirely. These are the questions that were brought up by the demand for regulation, and are not questions which led the people to demand such regulation.

One cannot say that the commission took up the other questions in any particular order, and in these comments the order in which the questions are enumerated is not meant to indicate in any way the importance apparently attached to them by the commission or by the witnesses. The commission asked those who came before it as to the advisability of eliminating the issue of capital stock, except at par, for money or property of the actual value of the par of the stock issued. This question is one which has been discussed widely in the public press, as well as in arguments before the Interstate Commerce Commission and before the courts. The interest in this question is one of the factors which unquestionably led to the appointment of the commission. The sale of stock below par, or the issue of stock to be given to buyers of bonds, is one of the grievances that the commission was appointed to investigate. Another is the question of the advisability of the prohibition or regulation of the sale of bonds at a discount. Closely connected with the question of the sale of stock at less than par is the question of whether it would not be possible and advisable to issue stock certificates without a par value, as is done, for instance, in the case of the Great Northern Ore Certificates, which simply state on their face that the holder or owner is entitled to share at a given percentage in the profits of the corporation and to participate at a given percentage in the distribution of the assets of the corporation in case of liquidation. Also closely connected with this question is the question of whether it is advisable to have a law forbidding the sale of new stock at par to stockholders when the old stock is selling above par in the market, or whether, if a commission is appointed to regulate the issuance of securities, they should be instructed in any way as to what their attitude should be in a case of the kind defined above.

Another question studied by the commission, the discussion of which by the popular press was unquestionably partly responsible for the appointment of a commission, is the question of the capitalization of betterments, additions and extensions charged in the past to income, but which might have been charged to capital. One needs only to name the Chicago & Alton to recall how often this question has been discussed in the public press, and to appreciate the great interest which was taken in it by the public.

Discussion about the valuation of railways is another reason for the existence of the Hadley commission; and the advisability of physical valuation and the relation of value of property or capitalization of property to rates are subjects that the commission has carefully studied.

There were innumerable other points brought up in the meetings, but those that we have mentioned would appear to indicate fairly accurately that the popular demand for an investigation was brought about by three causes. In the first place, state commissions and politicians, whenever they have reduced the rates of railway companies below what the railways thought just have been met in the federal courts by the plea of the railways that a reduction in rates was a confiscation of property. In most instances the railway companies have attempted to prove that they were not earning or would not earn, under the reduced rates a fair return on the value of their property. Among other things that the supreme court has held should be taken into consideration in determining the fair value of a railway property is the amount of securities issued against it, and also the market price of the securities.

There was a feeling that if the railways were going to set up as a defense the value of their property that value ought to be determined beforehand and that the nominal capitalization of railways should correspond to the value on which a fair return is to be earned. The general public did not or does not understand the railways' theory of railway rates or railway capitalization, and probably does not want to understand it. But the public, or part of it, found in actual practice that a certain form of defense was used successfully before the courts; and there was a strong feeling that some sort of a weapon ought to be given to state commissions which would enable them to pin the railways down and no longer permit them to squirm out in some mysterious way from the effect of orders of the commission.

The second object of the public undoubtedly was to prevent fraud. As a matter of fact, in recent years, fraud in the issue of railway securities has played a very small part compared with the fraud practised in the issue of mining stocks and other corporations. It is true that once in a while people have suffered, as for instance, the investors in the securities of a certain little road which went into the hands of a receiver a year or so ago, but it is noteworthy that in this case the corporation was obliged to obtain the consent of the New York Public Service Commission to the issue of its securities and the loss to investors occurred in spite of the fact that the New York commission had wide regulating power. The law recently passed in Massachusetts, briefly noted in these columns recently, which puts a penalty on a distribution of false information in regard to corporations, is a step toward meeting this public distrust of promoters.

The third reason for the demand for regulation is a sort of an endless chain. The men who have been writing for popular magazines in a popular style, on the subject of railways, telling half-truths in a lurid way that will appeal to the popular imagination, want to get more information. At the same time they have educated public taste in such a way as to create an appetite for more high finance stories, so that while demanding more publicity so that more materials may be at hand to write fresh articles the magazine writers have succeeded in making the public bring pressure to bear on the state and federal governments for their own ends.

The last of these reasons for the appointment of the Hadley commission will be discussed more fully later. The question of preventing fraud is so interwoven with national characteristics that it is not in the power of any commission to solve it. There was a curious failure on the part of the English economists, who expressed their views to the commission to understand exactly what it was all about, because they failed to see why the present laws did not adequately cover the subject. They failed to see why, if a certain thing were unlawful or dishonest already, there is any need of further legislation in regard to it. They failed to understand that American business and social ethics puts a premium on, rather than punishes, successful dishonesty that can be practised through an evasion of the law. They could not understand why, if a certain group of promoters or speculators had imposed on the public once there should be any danger that the public would again trust the same speculators.

In all the mass of evidence that was taken it is hard to find a single suggestion that really appears practical for the prevention of fraud or imposition on the public so long as the public refuses to insist on the enforcement of existing laws and refuses to use the ample information that is now available in making an investigation of its own investment.

THE EASTERN RATE MIX-UP.

SOME of the eastern lines have complained to the Interstate Commerce Commission about reductions in rates which the Delaware & Hudson and the Erie have announced, and have asked the commission permanently to restrain the reductions if the rates be found unreasonably low. The interstate commerce act provides that if the commission shall find any rate "unjust or unreasonable, or unjustly discriminatory, or unduly preferential or prejudicial, or otherwise in violation of any of the provisions of this act, the commission is hereby authorized and empowered to determine and prescribe what will be the just and reasonable individual or joint rate or rates, charge or charges, to be thereafter observed in such case as the *maximum* to be charged, . . . and to make an order that the carrier or carriers shall cease and desist from such violation to the extent to which the commission finds the same to exist and shall not thereafter publish, demand or collect any rate or charge for such transportation . . . *in excess of the maximum rate or charge so prescribed.*" It seems plain from this provision that Congress did not intend to give the commission power to advance any rate *after* it had gone into effect.

The amendment made by the Mann-Elkins act, giving the commission power to restrain changes in rates, provides that "whenever there shall be filed with the commission any . . . new individual . . . rate . . . the commission shall have . . . authority to enter upon a hearing concerning the propriety of such rate, . . . and, pending such hearing and the decision thereon, the commission . . . may suspend the operation of . . . such rate . . . but not for a longer period than 120 days . . . ; and after a full hearing when completed, or after the rate . . . goes into effect, the commission may make such order in reference to such rate . . . *as would be proper in a proceeding initiated after* the rate . . . had become effective." Now, as the commission cannot, *after* a rate has become effective, issue any order regarding it except to reduce it or to prevent it from being advanced, and if after it has suspended a change which a railway proposes to make and has conducted hearings regarding it, it can only issue such an order regarding it as would be proper in a proceeding initiated *after* the rate had become effective, how can it be that it can restrain a reduction in rates? Since it cannot raise a rate or prevent its reduction, after it has gone into effect, how can it issue an order restraining a proposed reduction before it is put into effect? It might be that on a very broad interpretation it would be held that the commission could suspend any change in a rate, whether an advance or a reduction, pending investigation; but in view of the language of the law, it is inconceivable how anybody who can read English can believe that the commission, after such suspension and investigation, could issue an order preventing a rate from being reduced or requiring it to be advanced.

While the commission probably has not the power to suspend a reduction or compel an advance in rates, various incidents that recently have happened have added much force to the argument in favor of specifically giving it that power. Without such authority it will never be able effectively and salutarily to correct all unfair discriminations between localities, commodities and shippers, and to protect carriers against reckless competition of one another.

Meantime, what a spectacle the eastern roads present to the public only a few months ago they were concertedly appearing before the commission petitioning for advances in rates and saying that unless they got them some of them might be forced into bankruptcy. Now some of them are appearing before the commission petitioning it to prevent others from making unreasonable reductions in rates. The questions involved could easily have been settled without a resort to rate wars. They could have been submitted to arbitration as was the Michigan Central passenger differential question a few years ago. But certain of the roads preferred to run amuck and give the public the impression that, instead of being as hard up as they were saying they were a few months ago, they now have money to throw away. It is evident a good many railway men have not learned much from the experience of the last ten years. If railway managers find the work they are doing to educate public sentiment regarding railway affairs less fruitful than they could wish, they can discover one of the principal causes in the fact that things are constantly being done by some railway men which belie much that is said and written by other railway men who are participating in this educational work.

NEW BOOKS.

Railroad Traffic and Rates. By Emory R. Johnson, Ph.D., and Grover G. Huebner, Ph.D. D. Appleton & Company, New York and London. Cloth; two volumes, 5½ in x 8¼ in.; volume I, 524 pages; volume II, 448 pages. Price, $5.

Dr. Johnson, professor of transportation and commerce of the University of Pennsylvania, is already well known to the readers of the *Railway Age Gazette* by his previous works on railway subjects, and Dr. Heubner is one of his associates. In "American Railway Transportation," Prof. Johnson gives one of the best brief histories of the development of railways in America; in "Elements of Transportation," he analyzes the business and work of the railway world for the benefit of young students; and now, in this last thousand pages we have in great fulness, an account of the intricate and detailed work of the traffic manager, the general freight agent, the general passenger agent and their helpers. The prospectus says that the work has been written mainly to meet the demand of men in the railway service for complete and authentic information. The first 40 pages are filled with generalities which may not be very attractive to the young railway man, but he should read them with care, nevertheless, for the chapter will give form to ideas which in the average head are often vague. For the rest, the list of the headings of the chapters, which is condensed below, will sufficiently indicate the scope of the work; and we need only add that throughout the two volumes every paragraph is marked by accuracy, thoroughness and evidence of mastery of the subject. Moreover, proofs of the work were submitted to prominent men for criticism before the book was published, and a long list is given of the names of railway officers who have performed this service. The very numerous blank forms, shown in facsimile, are copies, in most or all cases, of forms in actual service on prominent railways; many of them from the Pennsylvania.

The work is the result of notes and studies made by the authors during the past five years, in their teaching of advanced students in the University of Pennsylvania; yet it is brought fully up to date. For example, the status of the Pullman Company, since the Interstate Commerce Commission has had authority over it, is clearly set forth, and articles are quoted from the *Railway Age Gazette* up to within a short time before the book was sent to the press.

The first volume contains 25 chapters, divided into three parts. Part 1 is general; Part 2 takes up organization and management of freight service; accounting; car service and efficiency; private cars; fast freight lines; and freight traffic associations; Part 3 covers freight classification, tariffs and rate-making. The list of forms, maps and charts in this volume fills three pages. Volume II contains 22 chapters, divided into four parts. Part 4 contains organization of the passenger department; tickets; accounting; the Pullman Company; the baggage service, etc.; Part 5 is on passenger classification and fares; Part 6, the express service and railway mail transportation; Part 7, the Interstate Commerce law, as amended in 1910.

The Anatolian Railway, whose western terminus is opposite Constantinople, Turkey, has contracted with a great petroleum company of Roumania for supplying its locomotives with oil. The oil will be delivered by vessels at the railway terminus. The change of the locomotives from coal-burning to oil-burning will be made 25 at a time, and will begin immediately. The Bagdad Railway will be an extension of the Anatolian system.

Letters to the Editor.

THE SUPPLY DEPARTMENT.

OTTAWA, Ont., May 17, 1911.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

In your editorial note on my little paper on The Supply Department, in your issue of May 12, you show, quite correctly, that my paper is largely an interrogation. It is. Mr. Pearce makes statements; he does not prove facts, and I question those statements. Beyond doubt the proper procedure would be to prove the statements wrong, but that is just the trouble. I could give my opinion on the matter, but that would not be proof, no more than are Mr. Pearce's opinions. So I merely question his statements for the time being, with the hope that such questioning may help lead us to the truth.

Before we can say that a thing is good or bad, we must compare it with something of like nature, and in this matter of the supply department the comparison has never been made. Each railway has gone ahead in its own way, carefully concealing its figures, and results obtained, from other roads, and quite frequently from themselves; so while we may each have our own opinion as to the best methods we lack proof. Has Mr. Pearce compared the results obtained under his ideal plan with results under other plans? Has he facts and figures to show? If he has, we want them; if he has not, then his statements must stand as his opinion, or theory, only, not as proven facts, and we have a right to question them. Not in any unfriendly spirit, but simply with a desire for the truth and giving him full credit for his splendid piece of work. An artist may paint a beautiful picture, requiring great skill in its production, and it detracts nothing from his credit as a painter that his conception is ideal, rather than practical.

E. J. MC VEIGH,
Storekeeper, Grand Trunk Railway.

ARBITRATION OF RAILWAY LABOR DISPUTES.

CHICAGO, May 29, 1911.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

All railway officers, especially those who have been in actual contact with arbitration matters, must be interested in the discussion in your columns of the suggestion of Mr. Delano for the creation of a court of arbitration, which was made in his communication published in your issue of April 7.

We must remember that there are three parties to every controversy: two contending parties, and the public. We must remember, also, that there are three features which must enter into the adjustment of every dispute: first, some effort, in an informal way, to reconcile differences or draw the contending parties more closely together; second—in case of failure to secure settlement by conciliatory methods—an arrangement by which the differences will be submitted to arbitration; and, third, a complete understanding on the part of the public as to the merits of the controversy.

The public is entitled to have the information necessary to enable it to place the responsibility for failure to reach a settlement of a dispute which may result in interruption of a service so essential to its convenience and business prosperity as that of transportation.

A large majority of the disagreements which have occurred in negotiations regarding railway labor matters recently have been settled either through mediation and conciliation, as provided for in the Erdmann act; or by arbitration thereunder; or by some other form of arbitration agreed upon between the railways and the labor organizations.

Before suggesting improvements in methods that have been tried in the past, we should consider the results obtained by and the defects in those methods. The processes we have used have been well tried and we should not make radical departures therefrom without mature consideration. This leads up to consideration particularly of the Erdmann act.

The strength of the Erdmann act consists in the fact that it does not contemplate compulsory arbitration. Compulsory arbitration must be distasteful to both the railways and the employees, as, doubtless, there are many issues which neither would care to arbitrate.

The spirit of conciliation and mediation injected in the steps preliminary to settling a controversy or bringing about arbitration is another strong feature of the act. The situation at this stage would be improved if the law compelled the parties in dispute to desist from open hostilities until the matter in controversy has been carefully investigated and the facts definitely ascertained and placed before the public.

The statement that arbitration is desired by the weaker side is not quite true. The Erdmann act encourages the generous party, mindful of public interest, to arbitrate and settle its troubles without an interruption of service; but, at the same time, the Erdmann act may at times encourage weak negotiators to shirk responsibility.

The act might be strengthened by making it mandatory upon the chairman of the Interstate Commerce Commission, the commissioner of labor, or such officers as may be charged with such responsibility, to place themselves in communication with the parties to the controversy, and endeavor by mediation and conciliation to secure an adjustment of the controversy, or an arbitration of the points of difference.

The act should be broadened sufficiently to include the railway mechanical branches which are so closely associated with the transportation department. As at present framed it covers only controversies between railways and their employees *actually engaged* in *train operation* and *train service*. While it is obvious that trains cannot be operated without providing for the handling of engines and cars in shops and roundhouses, the act is not clearly and certainly broad enough to include car repairers, boilermakers, machinists and others of this class, and although it might be so interpreted it should be made somewhat more specific.

Under the present method both sides select their most efficient representatives. These two generally fail to agree upon a third man, and thus force the appointment of an "umpire." The third arbitrator is always a man of high principles, who accepts the service purely from a feeling of public duty, but who may not be properly equipped by experience or training to understand the problem in all of its intricate details. He may be misled as to the importance of what are apparently trivial details; or he may avoid the responsibility of a clean cut declaration of principles by a decision largely a compromise and based generally on purely the monetary considerations.

For the above reasons it would seem possible to improve the situation. A permanent court would permit of security in tenure of office; of the selection of experienced men, well equipped by special training, free from other duties and with sufficient opportutnity for a study of the whole broad question; and of the elimination of political influence. Such a court would seem to be a practicable arrangement from the standpoint of the work which might be thrown upon it; for with the opportunities for breaches between the roads and the employees restricted by concerted action, and actual disagreements still further reduced by the preliminary processes of mediation and arbitration, it is probable that no more cases numerically would be presented than could be handled with reasonable promptness.

The suggestion for a permanent court of arbitration appears attractive from the standpoint of increasing the possibility for judicial and careful analysis of the whole situation. It is questionable if either side would assent to an arrangement comtemplating a permanent court composed always of the same individuals. A permanent court, having once decided against a party to a controversy, might not again be acceptable to that same party;

whereas, an arrangement by which the personnel of the court or board of arbitration could be changed would remove this objection; and doubtless a party would again be willing to submit its further case to arbitration.

It is not obligatory to take controversies to a court of law. Mr. Delano contends that it should be more obligatory to take controversies in railway matters to arbitration, and suggests that the proposed court of arbitration should bear the same relation to labor disputes that a civil court bears to disputes between individuals. Compulsory arbitration of labor disputes certainly appears inexpedient and is an impracticable suggestion; and it is therefore evident that we must turn to some arrangement compelling the parties to a controversy to desist from open hostilities until the facts are made public.

As a suggestion, the law might be amended to provide that the President of the United States shall, when a controversy arises which in his judgment threatens to interrupt the public service, investigate the causes through a special commission. This special commission should be required to hear the case, enter upon and inspect the premises involved, utilizing experts to examine accounts, books or official reports, or anything material to the investigation. After such investigation the special commission should be required to formulate a report setting forth the causes of the controversy; locate as far as possible the responsibility, and make recommendations for ending the disturbance and for the prevention of a recurrence thereof. This report should be transmitted to the President and the public.

By this process a thorough and impartial investigation of the cause of the controversy and all the facts concerning it could be brought to the attention of the public, which is so vitally interested in the issue.

To summarize, the Erdmann act might be amended to require a member of the Interstate Commerce Commission and the commissioner of labor to put themselves in communication with the contending parties and endeavor by mediation and conciliation to bring about an adjustment of the controversy; and, failing therein, to acquaint the President with the situation, hostilities to be suspended until a commisson could be appointed to investigate the subject and prepare a report as outlined above. A thorough investigation and public report would in themselves create a public opinion which neither side might care to disregard. It would provide the only compulsory feature which would be practicable to inject into such proceedings under the present conditions.

F. O. MELCHER,
Second Vice-President, Rock Island Lines.

COST OF RAILS AND WATER TRANSPORTATION.

Chicago, May 27, 1911.

To the Editor of the Railway Age Gazette:

Perhaps the chief reason among many for the renewed interest in inland waterways is the popular belief that great economies in freight transportation would be effected by their development. Hardly an article has appeared in the press, hardly a public speech has been delivered, that has not emphasized the cheapness of water borne traffic. Indeed, the cost consideration is of primary importance, and it merits the share of attention it has received. Obviously the transportation system which can serve the country efficiently at the least cost is the system which should be established. But while much space has been devoted to the discussion of this phase of the subject, there has been unfortunately a dearth of real argument in support of the contention that water transportation is incomparably cheaper than that by rail. From mere assumptions of the inherent cheapness of water transport supported by rate comparisons drawn from dissimilar conditions, the most important conclusions have not infrequently been deduced, conclusions which seem likely to be of determining force in shaping our future transportation policy. In view of the public interest in the transportation question at the present time it seems in place once more to direct attention to the comparative costs of canal and railway transit.

The popular argument that water transportation costs only a fraction of that by rail runs somewhat as follows: The average price received by all of the railways of the country for the calendar year 1907 was 7.82 mills per ton mile. On the Great Lakes the charge was .8 of one mill per ton mile, and on the Erie canal about 3 mills per ton mile. A dollar, then, will carry a ton of freight the following distances: By rail, 127 miles; on the Erie canal, 323 miles, and on the Great Lakes, 1,250 miles. It has been estimated that the cost of carriage on the Erie barge canal, now under construction, will be but .52 mills per ton mile. At that rate a dollar will carry a ton of goods nearly 2,000 miles. President Ransdell of the National River and Harbors Congress had conservatively estimated water traffic to be about one-sixth as costly as traffic by rail, while others have placed the saving at a still greater amount.

If these statements of the tremendous savings by water transportation be true, it is perhaps in point to ask, Why then, must our waterways be subsidized? Why must they be built by the government? Why is it that we are confronted with the sorry spectacle of broken down gang-planks, of deserted wharves, and boatless rivers and canals? Why has not private capital been lured into this remarkably profitable field of investments? If a deep waterway from the Great Lakes to the Atlantic ocean or to the gulf of Mexico would drive competing railways from the field, why have not our great business men seized the golden opportunity? Why did such men as Daniel Drew, Commodore Vanderbilt and James J. Hill forsake the waterway, business in which they had been engaged, for the railways? The reason that practically everywhere in this country private capital shuns investment in waterways can hardly be because they are exceedingly profitable. The United States government from 1802 to March 2, 1907, appropriated $69,000,000 for canals and *canalized* rivers. In addition to this the various state governments and corporations have spent $214,000,000 upon canals. In spite of these enormous aids, however, our water borne traffic has steadily declined for many years. It would seem on the face of things, contrary to the popular conception, we have witnessed a survival of the fittest.

Let us, however, analyze the cost comparisons of waterways and railways as they are commonly made. The average cost of carrying freight on the Great Lakes or on the Erie canal is compared with the average freight rates on all the railways in the country. Now, this average railway freight rate is of a most composite nature. The computation thereof makes no distinction between high class expensive freight, and bulky commodities traveling at low rates. It makes no allowance for the length of the haul, severity of gradients, or expensiveness of terminals. It does not consider whether the consignment be in train load, car load or broken lots. Speed, kind of cars, degree of care, refrigeration—none of the varying conditions under which freight traffic moves are distinguished. All factors go in a parity in determining the average freight rate charged by the railways. It ought to be apparent that unless the average waterway rate is determined in the same way, unless it is derived from a similar complexity of conditions, the comparison is imperfect. No one would regard it fair to prove by a comparison of the rates on a railway that carried only coal with those of a road that carried all classes of freight under all manner of conditions that the former road was the more efficient or the more economical. The lower rates on the former would be held to prove nothing. In like manner the low water rates quoted ought to be regarded as at least inconclusive proof of the advantages of water transportation. The waterways carry practically only low grade freight, which must travel at low rates if it travel at all. These rates are, however, compared not with the railway rates on similar freight but with the so-called average rate on all freight of whatever kind. It is from such a comparison that the conclusion has been reached that transportation by water is cheaper than by rail.

A comparison of water rates with those charged by the rail-

ways on bulky traffic would not reveal a similar disparity. In fact, it is admitted that the railways have taken even much of the bulky traffic away from the waterways. They are, however, accused of doing this by unfair competitive methods, that is, by arbitrarily lowering their rates at competitive points. Now, such a lowering of rates to a point so low that canals are unable to compete for the traffic must mean one of two things: that the railways are carrying the traffic on which this is done at a loss, or that they are able to carry such traffic more cheaply than can the waterways under existing conditions. The railways might, indeed, carry traffic for a time at a loss, in the hope of thereby destroying competition, after which rates might again be raised, but no road would of its own accord permanently carry goods at less than the actual cost of moving them.

It is recognized that the advocates of waterways contend that while it may very well be true that under existing conditions the railways can defeat the waterways, the situation would be far different if the latter were properly developed and systematized. In this connection it is well to observe, however, that the railways of the United States are at present taking traffic away from the waterways even when conditions are well nigh all that could be desired, as between Chicago and Milwaukee on Lake Michigan, New York and Albany on the Hudson, and even upon the Mississippi.

But to return to the question of comparative rates—if the comparison of cost given above had been based upon similar classes of goods moving under comparable conditions, it would still be necessary to ask if the term "cost" has the same meaning in both cases. Unless the same elements be included under "cost" as applied to water transportation that are included in transportation by rail, the conclusions drawn are worthless. The average freight rate which we have been considering was obviously meant to secure a reasonable profit upon the entire investment in the railways of the country. The cost of building the roads, cost of equipment, of maintenance, and of operation, that is, the actual hauling expenses, all were considered in the adjustment of the rates on the railway. Let us now pass to a consideration of what is included in the term "cost" as used in connection with the waterways.

It is said that a dollar will move a ton of traffic on the Great Lakes a distance of 1,250 miles, as against 127 miles on the railways. But since the Great Lakes constitute a highway ready made by nature, the rates charged there need be merely sufficient to yield a reasonable profit on the investment in the ships, in addition to meeting the expenses of operation. Naturally the rates under such conditions would be much lower than if they had also to earn a profit on a tremendous investment in the highway itself. A comparison of railway rates with the charges on canals, which, like the railways, are artificial highways, evidently affords a fairer basis from which to drawn conclusions.

It is contended that one dollar will move a ton of traffic on the railways only a distance of 127 miles, as against 333 miles on the present Erie canal; and that with the opening of the new barge canal this distance will be extended to about 2,000 miles. What is meant by cost as applied to the Erie canal? It was built by the state of New York and donated to private use. Any one who desires can build a boat and engage in the carrying trade free of charge on the state's highway. If he can earn in addition to the operating expenses a reasonable profit on the cost of a small boat or barge he is satisfied. Thus, whereas the railway rate is fixed to cover a profit upon the total cost of the highway's equipment, upkeep, and operation, upon the railways, the rate on the Erie canal has to cover no part of the enormous expenditures involved in the construction and maintenance of the waterway itself. Thus the cost item which is by all odds of chief importance is omitted from computation. The cost of building and maintaining a canal, as in the case of a railway, is always the chief outlay connected with the transporting of goods. Indeed, it is the tremendous amount of fixed capital involved that particularly distinguishes the transportation business. Consequently, in comparing the relative cost of two rival modes of transit, to omit the enormous construction and maintenance expenditures in the one case, and to include them in the other is to totally invalidate the conclusions drawn. Yet this is the method that has been commonly employed in proving water transportation less costly than transportation by rail.

The people of the state of New York have voted an appropriation of $101,000,000 for the deepening of the Erie canal from 7 to 12 ft. This is an expenditure of approximately $300,000 per mile for the mere improvement of a waterway upon which many millions of dollars have already been expended. When it is reflected that the average capitalization per mile of all the railways of the country is only $59,259, the enormous costs of canal construction stand out in bold relief. For the cost of deepening the Erie canal, four fully equipped railway systems could be constructed between Buffalo and Albany. If $101,000,000 were donated to the railways of New York state, might not railway rates, within the state be reduced to a point so low that waterways, however subsidized, could not compete therewith?

It is believed that savings through reduction in freight charges will speedily repay the people of New York for the present outlay upon their magnificent enterprise. In support of this belief estimates of the yearly savings have from time to time appeared. One particularly extravagant and laborious computation which has come to the attention of the writer shows that the vast saving of $250,000 a year will be ensured upon the opening of the enlarged canal. Unfortunately, or rather, perhaps, fortunately, no mention was made of the fact that at that rate it will require 400 years for the canal to pay for itself.

In our enthusiasm for waterways, largely occasioned by a long standing prejudice agains the railways, we are all too prone to hasten to conclusions while totally disregarding fundamental considerations, involved in the transportation problem. Transportation must be paid for by someone. If the state builds and keeps in repair a transportation system, donating its use to the public, the cost of construction and maintenance is paid for by the inhabitants of the state in the form of taxes. The remaining cost—of equipment and operation, plus a reasonable profit on this investment, is paid by the shippers of traffic to the carriers thereof. On the other hand, if the means of transportation are privately constructed, the entire cost is paid by the shippers who make use of the transportation agencies. In the former case, a large part of the cost is borne by the general public, the apportionment being dependent, not upon the benefits derived from transportation, but upon whatever system of taxation chances to be in use. In the latter case the cost is borne by the shippers according to the use made of transportation.

There are waterway schemes before this country involving an initial expenditure of approximately $2,500,000,000. This vast sum, together with the interest which would accrue from a long period of bonded indebtedness, would constitute an enormous taxation burden for the country to bear. If the national government subsidizes the waterways, the greater portion of the cost must be borne by the consumers of tariff protected commodities, regardless of benefits derived from transportation, inasmuch as customs duties are the chief source of federal revenues. If the state governments finance the schemes, the owners of real estate will in most cases bear the brunt of the expense, because such is the incidence of the general property tax so largely employed in raising state revenue.

Let us not be deceived and be led to believe that because the cost is divided, part going to the government in tax payments, and part to the traffic carriers in transportation charges, that the total burden of transportation is thereby lessened. Let us also not overlook from whom is to come the greater part of the cost, and to whom are to accrue the chief benefits.

H. G. MOULTON,
University of Chicago.

LETTERS FROM AN OLD RAILWAY OFFICIAL TO HIS SON, A GENERAL MANAGER.

II.

Chicago, April 15, 1911.

My Dear Boy:—Nearly every man entrusted with authority over his fellows flatters himself that he is a born organizer. Flattery is never more deceptive than when applied to one's self.

For every good organizer there are a hundred good administrators or managers. What often passes for good organization is first class administration. Yes, many a mother's son who reads this will exclaim at first blush, "That is just what I have been saying for a long time. It beats all how weak some organizations are. I am glad that my organization can stand the test of such criticism."

If elements of self-perpetuation are prime essentials of good organization, the Pharisee family are certainly entitled to bid in the preferred runs.

The corporation was evolved to supply a demand of society. Life, property, material, moral and spiritual welfare could not be left to depend upon the uncertain earthly existence of the leader or trustee. So, both rationally and empirically, by reason and by costly experiment, came the corporation to beat Death at his own game. Like all progress the corporation was resisted, because in the divine scheme of things the radicals never long outnumber the conservatives. Like all real progress the corporation idea won because it was needed. The corporation, whether governmental, religious, industrial or commercial, marks a distinct advance from feudalism by protecting the rights of the many against the caprice of the few. Because we have moved so fast might has often seemed to be right. Because the line of least resistance is the most attractive, we have sometimes backed down the hill and doubled when a good run with plenty of sand would have carried us over. Large corporations, including many railways, have often failed to attain maximum efficiency. Much of this can be traced to a neglect to carry out consistently in practice the sound working conception of the corporation. The corporation has helped society to emerge from political and financial feudalism. The interior organization and administration of most corporations, including government itself, are still too feudal in conception. The problem of to-day is so to eradicate this feudalism that the corporation can have the benefit of a free play of its constituent forces. Where feudalism exists the effective working strength is limited to the personal equation of the man at the head. The United States government is stronger than Washington, or Lincoln, or Taft. The Great Northern Railway measures its present acknowledged effectiveness by the man the Swedes call Yim Hill. The United States government grows stronger with every administration. The Great Northern Railway, too strong to be destroyed, faces a period of relative distress with the next dynasty. The Pennsylvania Railroad is stronger than such strong men as Scott, Cassatt and McCrea. Both the United States government and the Pennsylvania Railroad, although among the least feudal of large corporations, can still eradicate feudalism from their interior organization and administration. That, in good time, both will do so cannot be doubted. Inconsistencies between comprehensive conceptions at the top and narrow applications at the bottom are often overlooked. When disclosed and appreciated these incongruities soon give way under pressure of the broad policies above. We must build up from the bottom but tear down our false work from the top.

Organization is a branch of a larger subject, sociology, the science of human nature. Organization is not an exact science like mechanical engineering, for example. The variables in the human equation defy entire elimination. We check and recheck engineering conclusions. We compute and recompute material strains and stresses. We run and double back with the dynamometer car to try out our tractive power. We test and retest materials. We weight and measure our fuel and our lubricants. We do all this for material things, which, because more or less homogeneous, are the easiest to measure. When we come to the really hard part, the judging of human nature, the co-ordination of the heterogeneous human elements, our self-confidence denies the necessity for preconceived practical tests. Because he is our man, because he followed us from the sage brush or the mountains, he must be all right. "Just look at our results." Right there my boy, shut off and pinch 'em down a little. What are results? Does any one know exactly? One year they are operating ratio, another, train load, and later on, net earnings. In no storehouse do material things deteriorate to scrap value faster than does the intangible, indeterminate stock article, results. No, I am not a pessimist; I still see the ring of the doughnut on the lunch counter. But I do object to being fed on birds from year before last's nests. I believe the railways hatch out better results every year, but I also feel that improvement should and can be made even faster. It is largely a breeding problem. How best can we blend our numerous strains to produce a balanced output? Too often we try to do this by cutting off the heads of all the old roosters whose craws really contain too much good sand to be wasted. A change of diet to a balanced ration may be all sufficient.

The wonderful Nineteenth Century in the name of a proper specialization went too far. It overspecialized. The still more wonderful Twentieth Century will swing back to a balanced specialization. The medical colleges are learning that they can not turn out successful eye and ear specialists, the law schools that the constitutional or interstate commerce lawyer is the production of a later period. The successful specialist must first have the foundation of an all-round training. Broadly speaking, one applies everything of something only by learning something of everything. We all believe in specialization. Where we differ is as to the point where specialization stops and overspecialization begins. We all believe in religion. Where we differ is as to which is the main line and which the runaway track, as to which derail deserves a distant banjo signal and which an upper quadrant. Orthodoxy is usually my doxy. The great fear is always that the other fellow, being less orthodox than we, will try to put over some constructive mileage on us. Sometimes this causes us to make his run so long and his train so heavy that he ties up under the sixteen hour law and we miss supper hour going out to tow him in. An empty stomach discourages drowsiness and we may then stay awake long enough to realize that said other fellow was just as orthodox as anybody about trying to make a good run.

The corollary of specialization is centralization. The undesirable corollary of overspecialization. is overcentralization. Get out your detour map, approach this proposition by any route of reasoning you please and you will reach the same conclusion.

Railway administration today suffers most of all from overcentralization. Trace this to its source and you will find overspecialization of function, and its concomitant, an exaggerated value of certain constituent elements of administration. When in doubt, recall the ever applicable axiom that the whole is greater than any of its parts. Some people confuse the terms and ideas, concentration and centralization. Proper concentration in complete units by an earlier convergence of authority permits decentralization in administration. A lack of such early concentration makes centralization inevitable. Again, concentration of financial control is not incompatible with decentralization of administration among constituent controlled properties. When the big bankers have time to think out these propositions for themselves they will permit the railways to get closer to the people and hostile legislation will diminish if not disapear.

Organization as a science seeks to develop and to support the strong qualities of human nature . Organization likewise takes account of and seeks to minimize the amiable failings of human nature. Constitutional liberty insures the citizen protection against the caprice of the public officer. Administrative liberty demands an analogous measure of protection for the subordinate

from the whim of his corporate superior. An amiable failing of many a railway president is to be satisfied with having everybody under his own authority, and to forget that the official next below may be embarrassed by having only a partial control. The general manager who insists the hardest that his superintendents are best off under his departmental system will squirm the quickest under the acid test of having the chief supply, the chief maintenance or the chief mechanical official report to the president. The superintendent who finds himself with a complete divisional organization is oblivious to the troubles of a distant yardmaster with car inspectors. When your old Dad was a ninety dollar yardmaster some of his most important work was at the mercy of a forty-five dollar car inspector. The latter was under a master mechanic a hundred miles or more away, who in turn could usually and properly count on the support of the superintendent of motive power. The obvious inference was to relieve the yardmaster of responsibility for mechanical matters. From one viewpoint these mechanical questions are too highly technical for the yardmaster. From another they are matters of common sense requiring more good judgment than technical training. No, I would not put every yardmaster over the roundhouse foreman and the car inspectors. What I would do would be to make the position of yardmaster sufficiently attractive to impose as a prerequisite for appointment a knowledge of mechanical as well as transportation matters. Gradually I would work away from the switchman or trainman specialist to the all round man in whom I could concentrate authority as the head of an important sub-unit of organization. Instead of leveling downward, as the labor unions do, by assuming that the average man can learn only one branch of operation, I would recognize individuality and gradually develop a higher composite type. Because some car inspectors are not fitted to become yardmasters is no good reason for practically excluding all car inspectors from honorable competition for such advancement. When we build a department wall to keep the other fellow out we sometimes find it has kept us in. We blame the labor unions for these narrowing restrictions of employment and advancement. Look once more for the source and you will find it among our predecessors in the official class, a generation or more ago. These officials insisted upon planes of department cleavage which the men below were quick to recognize. Railway manhood has been more dwarfed by exaggerated official idea of specialization with resulting departmental jealousies than by the labor unions.

Therefore, my boy, let us get some of these inconsistencies out of our own optics before we talk too much about the dust that seems to blind the eyes of those who are exposed to the breezes of that world famous thoroughfare which faces old Trinity Church in New York.

Affectionately, your own

D. A. D.

FOREIGN RAILWAY NOTES.

It is estimated that the operating expenses of the Chilean railways will amount to $13,125,000 for 1911, against $12,750,890 for 1910.

The Cuban inter-oceanic railway between Port Limon, on the Carribbean, to Punta Arenas, on the Pacific, was formally opened to traffic on January 14, 1911.

The French government has introduced a bill authorizing the Tunisian government to contract a loan of $17,466,500. The principal object is to provide for extensive railway construction, one section of which, when completed, will be in position to carry 400,000 to 500,000 tons of minerals yearly from the Nefzas and Nebeur districts to the port of Bizerta. The Tunisian government is further desirous of constructing four new lines, which would greatly improve the railway system of the country. The cost is estimated at $46,320,000. Two of these proposed lines are of particular interest, as they are designed to join the south with the north, and would touch Tozeur and Gabes.

FEDERAL V. STATE REGULATION OF SECURITIES.

In one of the discussions before the Securities Commission, attention was called to the fact that Congress might pass a law fixing certain conditions which would have to be complied with by all corporations engaged in interstate commerce before they could issue new securities; or, on the other hand, Congress might pass a law which would provide for the appointment of a commission who would have the power to permit, or refuse to permit, the issue of stocks or bonds by any company engaged in interstate commerce; or, as a third alternative, Congress might pass a law which would either compel or permit companies engaged in interstate commerce to incorporate under a federal charter. With federal incorporation it would be, apparently, a comparatively easy task for the federal government to regulate the issue of securities.

From the legal standpoint, two questions involved here are: the question of the power of Congress to regulate the issue of securities by existing state corporations, and the closely related question of whether Congress has the power to compel, or permit, corporations now chartered under state laws to incorporate under the federal law. The relation of these two questions is so intricate that it could only be adequately defined by the Supreme Court of the United States. For instance, it is possible that a way could be devised by which federal incorporation could be compelled on the ground that the federal government has an inherent right to regulate the issue of securities by companies engaged in interstate commerce. On the other hand, it might be found that, while the federal government had no such inherent right, it could gain much the same thing by permitting incorporation under the federal charter, and so regulate securities.

There was a sharp and rather unusually clean-cut difference of opinion between the various witnesses before the Securities Commission as to the legality of federal regulation of securities. Judge Lovett, while expressing his opinions in the form of "doubts," outlined a case against the legality of such assumption of federal power. While acknowledging that court decisions have sufficiently clearly shown that the federal government has the power to regulate any action of an interstate commerce carrier which affects interstate commerce, he doubts strongly whether the act of issuing securities and of the attendant bookkeeping transactions have anything directly to do with interstate commerce. His position was that the states now had the power to create corporations which could engage in interstate commerce; that the United States has full and unlimited power to regulate such interstate commerce activity, but that the state retains its original power over its corporation as a corporation; that the issue of securities is a corporate act, not an activity of interstate commerce.

Edward M. Shepard and Francis Lynde Stetson agreed with each other and with Judge Lovett in believing that federal regulation of securities of state corporations would be illegal; Mr. Stetson insisting that even if it were legal it would be very impolite.

The opposite view, that is, that federal regulation is legal and feasible, was taken, among others, by Robert Mather, Walker D. Hines and Burton Hanson. "The power which can regulate commerce can regulate the operation of a corporation whose object it is to provide a channel for that commerce," Mr. Hines said. Railway corporations have as their sole object the provision and use of a channel for interstate commerce. Regardless, therefore, Mr. Hines thinks, of whether capitalization and the issue of railway securities have anything to do or not with freight rates and the direct activities of interstate commerce, the federal government has the authority to regulate the acts of these corporations.

One of the witnesses suggested that inasmuch as the refusal of the New York Public Service Commission, Second district, to permit the issue of securities by a New York corporation engaged in interstate trade might seriously affect interstate com-

merce in Ohio, that this was a regulation of interstate commerce, legal, possibly, as long as Congress did not itself take any steps which would come in conflict with such regulation. If, however, Congress assumed some of the powers that it had in this regard and passed any laws which would conflict with the laws of New York or the actions of the New York commission, the state laws or rulings would become void. Mr. Hanson cited the hours-of-labor law as an example. In the *State of Wisconsin v. the Chicago, Milwaukee & St. Paul,* the supreme court of Wisconsin held that where Wisconsin had passed certain laws fixing the hours of service of employees engaged in interstate commerce, and where these laws had come in conflict with laws passed by the United States regulating the hours of service of employees engaged in interstate commerce, the state laws were void. The basic difference between the legal view as explained by Judge Lovett and that as explained by Mr. Hines was as to the extent to which the acts of a company engaged in interstate commerce could be differentiated as between acts of state corporations and acts of interstate carriers.

The view taken by W. D. Williams, of the Texas state commission, who emphatically opposed *any* suggestion of substituting federal regulation for state regulation, was that while the state could forbid a company chartered under its laws to engage in interstate commerce, and while the United States could forbid a company from engaging in interstate commerce unless it submitted to federal regulation, the United States could do nothing to annul the laws of Texas regulating its own corporations.

The suggested passage of a law compelling or permitting incorporation by all interstate commerce carriers under a federal charter has already been mentioned. Compulsory federal incorporation was not discussed exhaustively. One gets the impression from reading the testimony that most of the witnesses who mentioned it had considerable doubts as to its legality. The law *permitting* federal incorporation, however, was favored by a number of those who discussed it. It is worthy of note here that while Judge Lovett doubted the legality of federal regulation he had few doubts as to its desirability. Most of the states have either already passed laws regulating the securities of common carriers or may be expected to pass such laws, and it is on this ground that a great many of the witnesses favored federal regulation as the lesser of two evils.

Those who believed that federal incorporation is not only desirable, but feasible, thought that such incorporation would be in the nature of a license to do interstate business; and Mr. Untermeyer, for instance, sketched a general plan for federal incorporation of such existing companies as desired to avail themselves of the privilege. His idea was to have a law providing that if three-quarters of the stock desired federal incorporation, all of the stock could be compelled to come in, and that the refusal of a part would give the majority a right to buy out the minority under a fair valuation. His plan permitted a federal corporation to hold all the stock of a state corporation but not any part of it. It provided for a compulsory sale by the minority stockholders of a state corporation in case three-quarters of the stockholders wished to sell their stock to a federal corporation.

The discussion of federal incorporation leads naturally to the question of the *advisability* of federal regulation; first, if it were to exclude state regulation; and second, if it were to be superimposed on state regulation. As to federal supervision added to state supervision, with a few important exceptions there was a fairly uniform opinion unfavorable to a further extension of the present law. Those strongly in favor of a rigid regulation, as, for instance, Commissioner Clements, seemed to think that federal regulation was so necessary that if it were found that it could not legally exclude state regulation, or that a law was passed which did not exclude state regulation, nevertheless it should be superimposed and much extended. Nearly all, however, of the witnesses who had had experience in being "regulated," regardless of whether they were bankers, railway men or lawyers, were strongly opposed to the conflict of adding federal regulation to state. Neither corporation lawyers nor state commissioners were agreed among themselves as to the success of regulation of interstate commerce carriers by state commissions. Paul D. Cravath was so impressed with the success of the New York Public Service Commission, Second district, that he asked a number of railway officers for whom he was counsel whether they would be willing to go back to the time before the Public Service Commission, if that were possible, and not one of them was in favor of such a retrogression. Walker D. Hines, from his experience with the Texas commission, gave the impression of holding up his hands and begging for anything but state regulation.

The principal points that were made in favor of state regulation were the advantages to be gained by the knowledge of local conditions and by the power to act promptly. Numerous instances of the benefits of such local knowledge and informal prompt action were cited by those who discussed the work of the Massachusetts commission, the New York Public Service Commission, Second district, and the Wisconsin commission; in fact, most of those who favored state regulation as opposed to federal regulation had had to deal or were familiar with the work of one of these three commissions, while those who were most bitter against the state's assumption of any more authority had had to deal with such commissions as that in Texas or that in Louisiana. Those who advocated the assumption of authority by the states valued the advantages to be gained by a sort of paternalism more highly than the uniformity to be gained by federal regulation.

All of the men who testified before the Securities Commission who had had to deal with the financing of short new lines, or in fact any new lines, were agreed in their distrust of state regulation and in their strong preference for uniform federal regulation. This question of financing new short lines came up again in the discussion of issuing stock and bonds below par and at a discount, but it is also of the greatest importance to consider it here in discussing the advisability of federal regulation. The preponderance of opinion among those who actually had to deal with financing of new short roads was that capital, with certain exceptions, could not be raised locally to build such roads. Testimony by members of the Wisconsin commission showed that their experience had been an exception. Wisconsin is a comparatively newly settled state, but it is rich—not rich in the sense that the French peasant is rich, but rich in the sense that its resources are being developed more rapidly than the expenditures of the country consume the wealth, and the surplus is therefore available for local investment in enterprises which do not become profitable for some little time. The consensus of opinion seemed to be that this happy condition does not exist in the rest of the country.

The rest of the country badly needs railways. It is not necessary to go to the testimony before the Securities Commission to discover the fact that people think they need more roads. The construction columns of the *Railway Age Gazette* are filled with plans and projects which are indefinitely delayed, or are never carried out, because of lack of capital. There was certainly no one who suggested before the Securities Commission that capital did not shun uncertainty, and the evidence tended strongly to show that a state commission, especially in the western states, with power to regulate the issue of securities, did not make for security of property rights. In other words, while conditions of operation might be local, and what would be appropriate in one place would be inappropriate and harmful in another, the financing of even a 25 or 50-mile intrastate line was often an international affair. There were two men whose testimony was based on expert knowledge, F. J. Lisman and Robert Brookings, who have had a very broad experience in the financing of small roads. Mr. Brookings is a St. Louis banker and is representative of capitalists in St. Louis who have done considerable of this sort of financing. F. J. Lisman has financed the building of

roads in nearly every part of the United States. It is worth while describing the Wisconsin method of financing these short roads, and then Mr. Brookings' and Mr. Lisman's methods.

In Wisconsin, when a community 50 or 60 miles from the nearest railway wants a line built, it first tries to persuade the existing line to build a branch. Failing in this, it raises capital locally to provide funds for by far the greater part of the cost of building such a line, and then possibly it sells to an eastern capitalist bonds representing as low as 10 per cent. of the total cash invested in the project. These bonds having behind them such a large equity, sell at a fairly reasonable price. The road possibly is not profitable for a few years, but the local men who put their money into it get a return through the increased value of their crops, their land and their town real estate. In time the road may become of enough value to attract the line with which it connects, and the large railway company then buys in the property from the original builders. Such a line as this is extremely cheaply built. It has the local people with it; it possibly has grants of right of way, timber for ties, and possibly of a certain amount of free labor for grading, etc., provided by the farmers.

From the testimony of both Mr. Lisman and Mr. Brookings, their method of building a new line is much the same as if they were local people, except that they have the capital back of them. They go in and build a line which a big railway company would not undertake to build, building it cheaply with the help of local enthusiasm and desire for an increase in real estate values, but they finance the project by the sale of securities of the company that they form to their *own* customers. Mr. Lisman testified that his customers included men in nearly all parts of Europe as well as in the United States. In nine cases out of ten the customers of these bankers buy securities from them, knowing comparatively little about the security itself but having implicit faith in the judgment of the banker. The banker, therefore, in selling his securities stakes his reputation and judgment on their soundness; and the testimony before the Securities Commission apparently showed strongly that bankers were unwilling to take the chances with their reputation that were entailed by the investment of other people's capital in states like Texas, with a radical state commission.

As to the financing of new short lines by existing large railway companies, it was pretty clearly shown in the testimony that these large companies were not willing to build lines as rapidly as the country through which they ran demanded. There seemed to be a general feeling that a railway company, with its great number of security holders who were dependent for their income on their investments, did not have the moral right to engage in speculative railway building on any very large scale, and it is really speculative railway building that the settlers in a new country want. In this connection it is worth while taking such a list as the Pocket List of Railroad Officials and running through it to see how great a number of short railway lines there are in the United States. There are many hundreds of lines 25 to 100 miles long scattered all over the country, and the development of the country has been immeasurably hastened by the building of these lines. A trip through Oregon, Texas or the southeastern states would be sure to convince any fair-minded man that there is still a field for more of these lines.

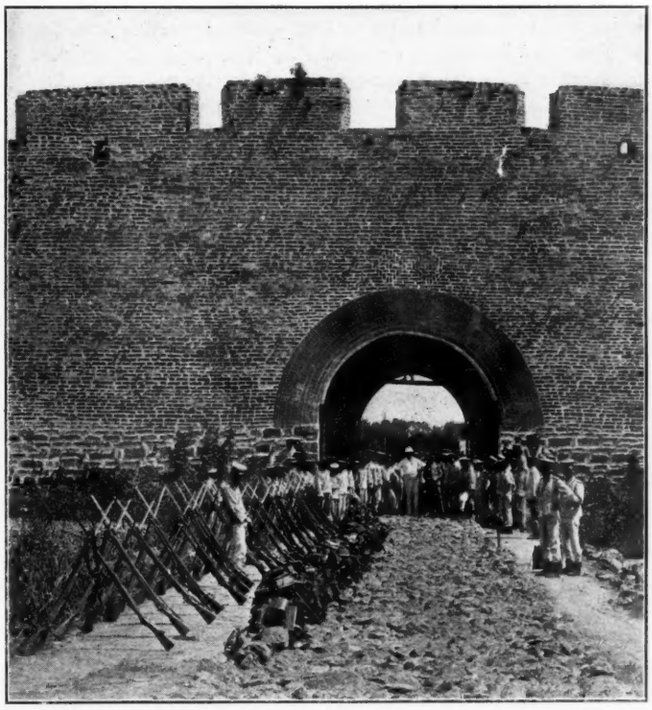
Regardless, therefore, of the difference of opinion on the general question as to the advisability of federal regulation of the issue of securities in place of state regulation, the testimony before the Securities Commission apparently indicated quite clearly: first, that new lines needed to be built; second, that in general these lines could not be built with local capital; and third, that uniform federal regulation will be far more likely to attract capital into such enterprises than would diverse and erratic state regulation. Moreover, the preponderance of evidence seemed to be that the issue on a large scale of securities by existing railway companies whose lines ran through a number of states was, if it were to be restricted at all, a national rather than a state question.

CHINA'S MOST MODERN RAILWAY.

BY LEWIS R. FREEMAN.

The Shanghai-Nanking Railway is known to foreigners in China as the best built and best equipped road in the Far East. To the Chinese it is known as their most expensive lesson in giving to foreigners full control of expenditures in enterprises for which they furnish the money. The Chinese are aggrieved in the matter because they feel that, for the sake of the 5 per cent. commission which went to the British corporation on all purchases made abroad, they have been put to an expense far greater than they could afford; "butchered to make a British holiday," as one of them expressed it.

The British are aggrieved that the Chinese are not more appreciative of the excellent road which has been built for them. They feel that the Imperial government is not giving them the support that it should in their strenuous but up to the present vain efforts to put the line on a paying basis. The Chinese, while admitting the superior construction, which should require few renewals of any description for many years to come, say that their country is poor and for that reason that half the money expended on the railway would have given them a line quite commensurate with their wants, and still more so with their finances.



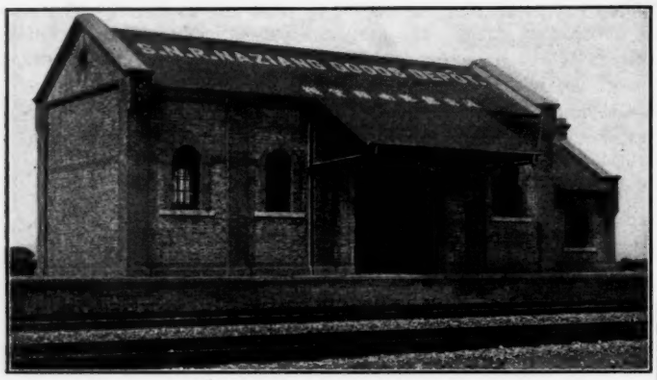
First and Only Railway Tunnel Through the Great Wall.

It is not the purpose of this article to discuss the much-mooted question of the expense of the Shanghai-Nanking Railway, which, though built through a practically level country, has cost about $55,000 gold a mile. It is well to note, however, that it is the one instance above all others which the Chinese cite in contending for full control of the expenditure of borrowed money, and it may be said with certainty that never again will foreigners of any nationality be given so free a hand in the construction of a railway in China.

The two points regarding the Shanghai-Nanking Railway about which there are no differences of opinion in any quarter are, its permanence of construction and the sincerity of the efforts of its foreign staff to make a financial success of it in the face of the most discouraging odds. This foreign staff numbers at present about fifty, and if honest and determined effort can make themselves count in Chinese railroading as in American it will not be

long before the line is paying good returns on even the large investment which it represents.

My first inkling of the character of the Shanghai-Nanking Railway was last September, when its general manager told me that it was going to put the Pacific Coast Commercial Commission through to Nanking over a roadbed as good as any in



Freight Station at a Small Town.

America and at a speed equal to that of the expresses between New York and Chicago. He said that if it were not for the many stops the special would have to make he wouldn't mind undertaking to do the 200 miles to Nanking in three hours and a half. As a matter of fact, we got up to 65 miles an hour in the middle of two long tangents. The train, with baggage vans, consisted of nine or ten cars, and in spite of the high speed at times attained it ran so quietly that it was possible to converse in ordinary tones, and so smoothly that one could write comfortably not only in the private cars but in the ordinary first-class compartments.

Although a good deal of trouble was encountered with the country people during the construction period on account of graves, labor difficulties and the disturbance of "feng-shui" (a term meaning literally "wind and water," to which an interminable lot of Chinese superstition is attached) the people have taken most kindly to the line as a means of travel, with the result that the passenger traffic has increased until it now exceeds

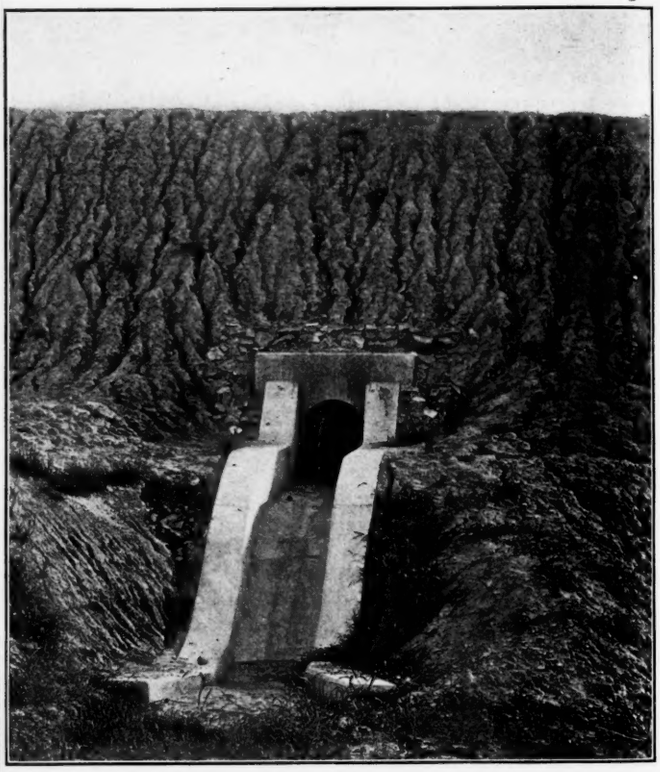
The Awakening of China; Some Reactionaries.

that of any other 200-mile stretch of line, single or double track in the world.

The passenger fares on the line are low, being approximately two cents, one cent and half a cent a mile for first, second and third class travel, respectively. A fourth or coolie class, carried in cattle cars provided with wooden benches, is charged about one-third of a cent per mile.

Over 95 per cent. of the passenger traffic is third and fourth class, and most of the remainder second class; yet in spite of this large proportion of low fares the passenger receipts of the line average almost ten times as much as those from freight. This shortage of freight has made it impossible for the road, in spite of vigorous and skillful management, to operate at a profit.

The country traversed by this railway, for the most part a great alluvial plain deposited by the Yangtse-Kiang, is one of the very richest in China, and in no part of the empire is there a greater movement of produce and other things from one section to another. Lying practically level, as it does, and almost even with tide-water, the country is a network of creeks and canals, by which all of the heavy carrying has been done for ages, in junks and sampans, either singly or in trains towed by launches. For goods requiring quick delivery, and for all goods between points where water communication is unusually circuitous, the railway quickly showed that it could compete with

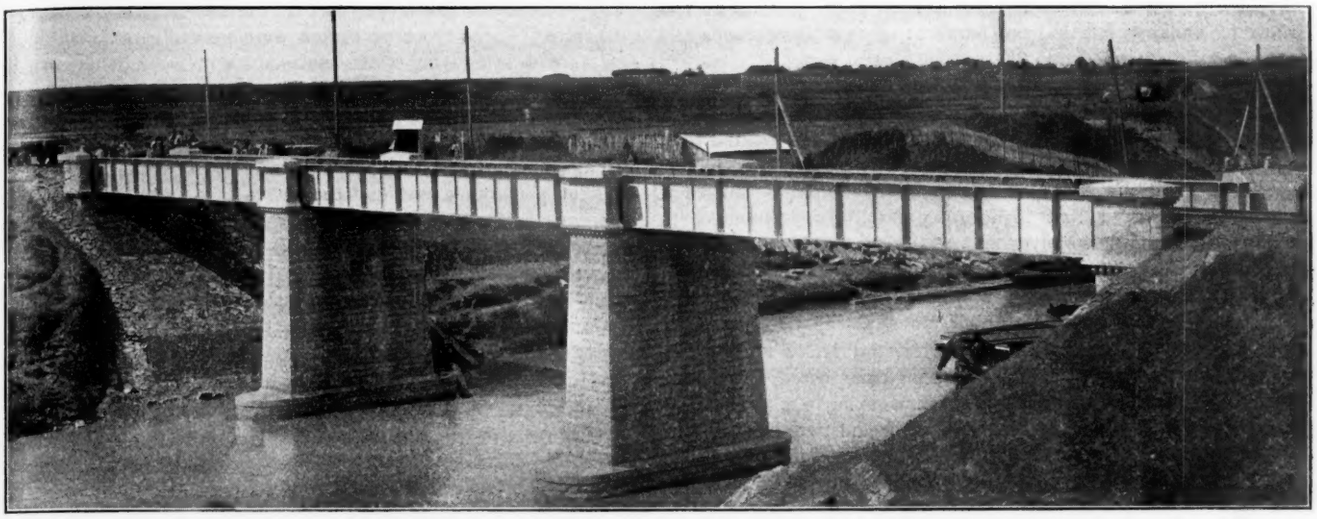


Embankment After Heavy Rainfall.

the low tariffs of the creeks and canals. Here, however was encountered the bête noir of all foreign merchants and shippers in China, "likin."

Likin, which might be traced back to the tribute paid in days past by the caravans to robber chiefs for safe-conducts, is a sort of internal tax levied on goods passing, not only between the provinces, but often also between certain districts within the provinces. It is levied according to no fixed scale, but rather follows the rule of the tourist hotel which maintains a sliding schedule of rates, according to the means or helplessness of its victims. It is one of the most fruitful sources of graft for corrupt Chinese officials, and as such will be painfully slow in eradication.

A large part of the income of officials resulting from likin comes in the form of bribes for "neglecting" to levy it. This is where the railway's trouble comes in. Every ton of freight going over its line shows on its records, so that a consignment passed without paying likin could easily be traced by the Peking officials, a thing which would be almost impossible under the hit-or-miss system of collecting—or failing to collect—that duty from junks. So the shippers, for the most part, have found it



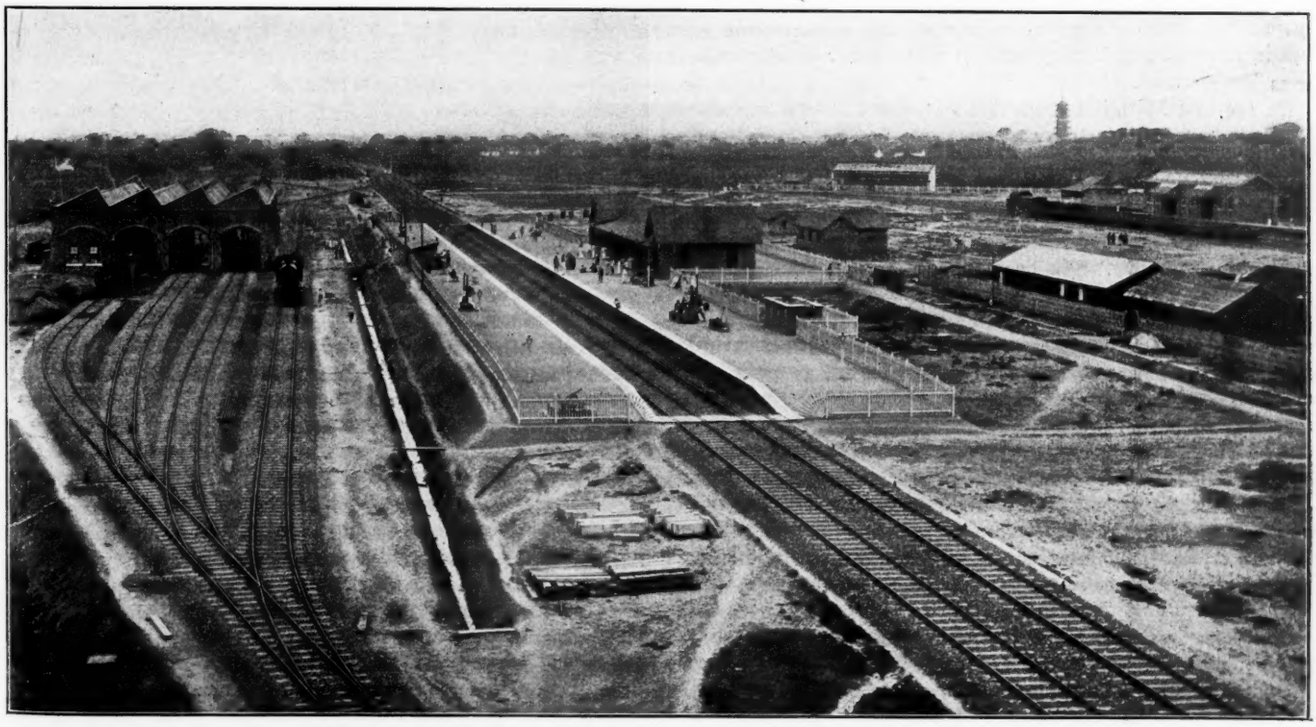
Girder Bridge Over Canal; Shanghai-Nanking.

more profitable to move their goods slowly by junks on the canals and creeks, taking their chance of avoiding likin by small bribes, than to move them quickly by rail and pay the full duty. A slight lowering of the likin tax to be paid on the railway through a ruling of the viceroy at Nanking had but little effect in improving the situation.

As a consequence of this pernicious likin tax, the Shanghai-Nanking presents the remarkable anomaly of a road with a remarkably heavy passenger traffic scarcely able to earn enough from freight to grease the wheels of the cars. A fraction of the freight which is passed free of likin, through bribery, at the barriers along the creeks and canals near the line would be enough to give the road a surplus instead of a deficit. This diversion might be accomplished by the abolition of likin altogether or the honest collection of it on the creeks and canals, either of which courses, if followed by the government, would reduce water freighting to a position of fair competition with the railways.

The Shanghai-Nanking, as mentioned, is principally remarkable for its modernity of construction. The following notes, except for occasional comments, are from the report of A. H. Collinson, M. I. C. E., the chief engineer of the line. It was built by the British and Chinese corporation, which furnished the money, for the Chinese government. From first to last, British engineers were employed, British materials used and British practice followed, until today the completed road, except for certain local provisions, has every ear-mark of a line in the heart of England itself. Westinghouse air brakes are used, but they were doubtless bought through London.

The preliminary agreement for the acquisition of a loan for the building of the Shanghai-Nanking Railway was signed in 1898, and the final one, providing for a loan of $16,250,000, in 1904. The final surveys and estimates were made during the summer of 1904, and construction was begun in the fall of that year. Considerable trouble was experienced in the initial stages over the acquisition of land, and little active work was done be-



Through Station on the Shanghai-Nanking.

fore the spring of 1905. Three years later the first train was run into Nanking, but the completion of some of the stations and other details extended into the present year.

The engineers were confronted at the outset by that most annoying of all Chinese engineering problems, the avoidance of graves, and this difficulty was magnified by the fact that the road had to run through the heart of the Taiping rebellion country, itself one great graveyard. Early in his examinations the chief engineers concluded that in locating the railway attempts to avoid all the countless graves and houses would mean a line too full of curves to allow any kind of fast or economical operation. The line was therefore built as straight as possible, avoiding only ancestral halls, tombs and monuments.

The total length from Shanghai to Nanking is 193 miles. The section to Soochow, 54 miles, has been constructed for double track, the extra cost over single track working out in the proportion of five-twelfths for the bridgework and two-fifths for the earthwork. Over 125 miles of the line has a grade of less than 0.1 per cent. The aggregate length of curves between Shanghai and Nanking is 19.8 miles, or 9.75 per cent.

From Shanghai to Tanyang the line crosses the highly cultivated alluvian plain of the Yangtse-Kiang valley, which is intersected with a net work of canals and creeks. Here the country changes, the line traversing an undulating and rising ground until it reaches a ridge or watershed at mile 144. From this ridge it descends on easy gradients to Chinkiang City, passing through an undulating country requiring heavy cuts and a tunnel.

From Chinkiang the alinement runs at the foot of the hills as far as Lungtan, avoiding the outer country subject to periodic innundations. From Lungtan the route runs through hilly country to within 1½ miles of Nanking, involving very heavy earth work both in cuts and fills. The summit is reached at mile 146, the rail level being 91 ft. above low-water mark at Shanghai. The terminus at Nanking is on an embankment, the only practicable site for the station yard being on low, swampy ground on the south bank of the Yangtse-Kiang. Since this was subject to innundation, it had to be raised an average of 15 ft.

The standard width of embankment for double track at formation level is 30 ft., and for single track, 17 ft. 6 in. Single track cuts are in general 25 ft. 6 in., and double track 38 ft. at formation level. The usual slope of the cuts is 1½ to 1, but in some cases this had to be increased to 2 and even 3 to 1. From Shanghai to Tanyang nearly all the embankments were made from side-cuts. Beyond that point portable light railway was largely used.

In the first 144 miles something less than 5,250,000 cu. yds. of earthwork of all classes was required; for the last 49 miles, about 5,000,000 cu. yds. The earth work for the latter, or hilly, section cost $375,000, an average of a little over seven cents a cubic yard. The work throughout was let by contract to native contractors at schedule rates, payments being made from measurements from cuts or in borrow pits. The slopes of most of the cuts were turfed to prevent erosion, but with only moderately satisfactory results. The rains at the Nanking end of the line are extremely heavy at times, one shower being recorded in the late summer of 1910 in which 9½ in. fell in eight hours. The force of the rain-drops alone on this occasion scoured most of the turfing from the slopes of the embankments and cuts.

The bridgework in the first 80 miles of line almost establishes a record in point of number of structures necessary, for in this comparatively short distance, 164 navigable creeks and canals are crossed, an average of more than two to the mile. From mile 80 on to Nanking the average is more than one to the mile. The total number of bridges is 303, and in addition there are 405 culverts.

With few exceptions the bridges which have been built for the double lines are entirely of brickwork in cement on concrete foundations. From Soochow, the end of the double line, to mile 144 the majority of bridges are constructed of coursed granite set in cement on concrete foundations, while for the rest of the way to Nanking the larger part of the sub-structure consists of concrete. Three types of bridge were generally adopted: abutments with splay wing walls, abutments with straight return wing walls, and pier abutments.

Wherever clearance would permit arched superstructure was adopted, but in the majority of cases steel girders had to be used. The majority of the creeks crossed were navigable, so sufficient clearance had to be given to allow boats to pass with their masts down. The clearance was invariably fixed from that of the lowest existing bridge on the creek.

Great difficulty was encountered in the construction of many of these bridges. The foundations, hardly without exception, were bad, as was to be expected in an alluvial plain, necessitating heavy charges for cofferdam, timbering and pumping work.

A Typical Cut on the Shanghai-Nanking.

Many of the foundations had to be piled, and in the smaller openings concrete inverts and apron walls were found necessary. The total cost of the bridges for the whole line was a little less than $1,000,000.

Following the custom of the country the main line is unfenced. As all fields are open in China, stock is never allowed to run at large unless attended. For this reason the lack of fencing causes very little inconvenience. All the important stations and shop yards, however, are surrounded by six-foot unclimbable wrought iron fencing.

The main line is laid with 85-lb. steel rails, 36 ft. long and five and a half inches high. Strangely enough the rail is almost exactly the height and contour of the Chinese pillow and nothing can prevent the tired laborer from stealing a mid-day nap with his head comfortably resting on one rail and his feet braced against the other. This forces the engineman to come to many an abrupt halt. The ties are of Australian jarrah, spaced 14 to a 36-ft. rail, or 2,060 to a mile. These ties cost from $1.50 to $1.75,

c. f. i. They are the first jarrah ties to be used in China, so their life is a matter of conjecture. As they have been used without impairment for from 20 to 25 years in similar climates, there appears to be no reason why, with good ballast, they should not do equally well in China, and justify their use in place of the lower priced but shorter lived Japanese ties.

The line is ballasted throughout with bottom ballast consisting of large stones about 12 in. x 6 in., 8 in thick, hand-packed. The top ballast is stone broken to pass a 2-in. ring. The ballast for the first 144 miles is Soochow granite, brought by junk from the quarries of the Tai Hu lake. For the remainder of the line the ballast was quarried from the hills in the vicinity of the railway and transported in wheelbarrows or on donkeys. The capital cost of the permanent way, including all materials, laying, lifting, boxing up and maintaining for an average of six months after the opening of traffic, varied from $13,000 to $17,000 a mile. The total charged to track is about $2,400,000.

The only tunnel on the line is the double track one through the Fort hill at Chinkiang, on a down grade of 0.3 per cent. into Chinkiang station. Many trial lines were run with the object of eliminating the tunnel altogether, but it was conclusively proven that the only other way to approach Chinkiang was by a switch-back, which would cost more than the tunnel. The tunnel is 1,320 ft. long. Nearly the entire length is through a shaly sandstone having streaks of graphite and pockets of China clay. The shaly nature of the rock necessitated the arching of the roof throughout its entire length, and also lining the side walls with brick in cement. No invert was deemed necessary.

In July, 1905, a trial shaft was sunk at about the center of the tunnel. By the end of August the shaft had reached a depth of 85 ft. Work was started in August in driving the bottom heading at the west portal. By the end of September the shaft had reached its full depth and water was found at rail level, 115 ft. from the surface. A bottom heading, 8 ft. 6 in. wide at the base and 6 ft. 6 in. high, was commenced in both directions. The small amount of water met with was easily dealt with, the progress being at the rate of about two feet a day, while four feet a day was made in the heading started from the west portal. At the close of the year 1905, 425 ft. of heading had been driven.

The headings from the shaft and west face met in May, 1906. During the nevt four months the progress of the work was more rapid, the Chinese miners who at first were unaccustomed to the labor having gained more experience under the foreign supervision. At the end of the following year 190 ft. of tunnel had been excavated and lined, and break-ups started between a second shaft and the east portal, giving in all six headings. The tunnel was completed in February, 1908.

The whole of the excavation and brick work in the tunnel was carried on by Chinese labor, and it is a remarkable fact that not one fatal accident occurred in the course of construction. Notwithstanding the fact that it was two years and a half in the building, the final cost of this tunnel was only $185,000. The lowest tender received from a European contractor for the work was $300,000.

The Shanghai-Nanking is the first that ever pierced the Great Wall of China and it aroused a great deal of hard feeling at the time. An accompanying illustration shows a detachment of troops guarding the tunnel against any possible outbreak.

The stations, shops and rolling stock of the Shanghai-Nanking Railway are quite up to the standard of the construction which has been described and whether or not the road is "too good" for the Chinese, as they now maintain, is a question which only the years to come can decide. If these years witness the progression in Chinese ideas that the present promises, it would seem a safe prophecy to say that it will not be long before they are congratulating themselves upon the fact that the Shanghai-Nanking was builded for the future.

The Choapa to Monte Osario Railway, Chile, was opened to traffic on January 5 last.

STUDIES IN RAILWAY ECONOMICS. VIII.*

BY W. M.* ACWORTH.

For my own part I am quite unable to accept the principle of limitation of dividends as a reasonable basis for government regulation of railway rates. In the first place, it rests on two fallacies of theory. Many states in the union still retain on their statute book the old laws against usury inherited from England in an earlier stage of economic development. There is a legal rate of interest fixed, usually at 6 per cent., which may not be exceeded. Of course, in modern commercial business these laws are evaded by one method or another, but they really are on the statute books and could be pleaded in a case in court. And apparently the American public think there is a real analogy between a fixed rate of interest on a loan probably granted with ample security, and a dividend which fluctuates and may vanish altogether, and which merely represents the profit made by a shareholder from his own management of his own property.

The other fallacy is a more subtle one. A railway, according to English, and therefore American law, is a public highway, and as such, the charges on it are subject to public regulation. The Americans have pushed the English doctrine further, and are in the habit of speaking of railway companies, and other companies that furnish public facilities, as "public utility corporations." They seem to have ignored the fact that a railway performs the duplicate function of roadowner, and therefore toll taker, and also carrier along the road. Now, while the English legislature has always regulated the tolls of the owners of roads, whether canals or turnpikes, it has never attempted to regulate the carrier's charge.† The common law does indeed say that the carrier's charge must be reasonable. This, however, is only another way of saying that, if two parties have not agreed beforehand what shall be charged for doing a certain job, the court will fix it afterwards on a *quantum meruit*. The court might refuse to recognize an advertised scale of carriers' charges as evidence of a free bargain between the individual consignor and the monopolist carrier, and as it would lack the guidance of a scale fixed by a rival carrier it would no doubt decide the question of reasonableness with a freer hand than in an ordinary dispute between a tradesman and his customer. But there is nothing special in the principle. If the American courts and commissions are to judge the reasonableness of rates on the basis of the profits made by the company, they should logically begin by dividing rates after the French fashion into tolls (*péages*) and carrying charge (*prix de transport*), and confine their operations solely to the first portion. But I confess that the reduction in toll revenue would justify the companies in seeking a larger revenue as carriers so the change would not be of much practical utility.

From the practical point of view the contention seems to me equally unjustifiable. "Heads I win, tails you lose," is an excellent way of playing a game from the point of view of one side, but it is difficult to get the other side to take a hand in it. An investor in the United States can get 6 per cent. or something pretty near it, without taking risks; and a holder of railway shares takes risks by no means negligible. Men hardly middle-aged can remember Baltimore & Ohio shares being regarded as a proper investment of public funds; the company has since passed through a receiver's hands. Union Pacific shares have been quoted at 220; but also at 5 within 15 years; and so on. It is absolutely certain, with railway dividends limited to 6 per cent. or anything like it as a maximum, railway development in the states would come to an an abrupt stop. And, while it may be not

*Previous articles in this series appeared in issues of the *Railway Age Gazette* of January 6, January 13, January 20, January 27, February 3, May 19 and May 26.

†Of course, the British Parliament has, from very early days, fixed railway *maximum* rates. But these it has fixed on quite other principles, certainly not on the basis of a theoretically reasonable dividend. In the states some old companies have *maximum* rates, absolutely without practical importance today, in their original charters. But there are no *maxima* in Interstate traffic.

unimportant to a certain number of manufacturers and wholesale traders, though only rarely to the ultimate consumer, that a rate should be reduced, say from 70 cents to 65 cents, it is absolutely vital to every citizen of the United States that railway developments should continue.

Nor is this all. Even if we were to admit that rates giving a total return in dividend of over 6 per cent. were not reasonable, the practical difficulty of deciding what rates shall be reduced and by how much so as to bring the dividend down to 6 per cent. is insuperable. Imagine a case brought up before a law court which had accepted the theory, that rates, producing when all combined together, a net revenue of more than 6 per cent. were unreasonable. A railway is paying 8 per cent.; a particular trader claims that his rate between A and B for the carriage of coal—to take an unusually simple instance—is unreasonable and should be reduced. The court is now required to put the theory into practice. Let us see how it is to be done. Somebody may answer without reflecting: "to reduce 8 per cent. to 6 per cent. is to cut off one-quarter; you have only to bring down the coal rate from 4s. to 3s. and the thing is done." But, alas, the matter is not so simple. The dividend is only the ultimate result after working expenses, depreciation, betterments, renewals, interest, taxes, etc., have been provided for. "Well then," says the impatient critic, "be it so. The rate should be reduced not in proportion to one-quarter of the gross receipts, but in proportion to one-quarter of that portion which goes in dividends, which, in this case is 10 per cent. of the gross receipts." Now one-quarter of 10 per cent. equals 2½ per cent. In other words, the coal rate is to be reduced from 4s. to something slightly over 3s. 10¾d. If the matter stopped at this stage one might be permitted to doubt whether the gratitude of the coal owner, taking into consideration the trouble and expense of his legal proceedings, would not be a negative quantity. But in fact the matter is much more complicated than this. It is true that for all the traffic of the railway, carried under all sorts of conditions, at widely different rates for widely different distances, the result has been on the average a profit available for a dividend of 8 per cent. "But," says Albert Fink in words that ought to be stamped in gold letters on every railway commissioner's desk, "no traffic ever is conducted under average conditions." That the special coal traffic in question did not pay precisely 8 per cent. is almost a certainty; for where infinite variations are possible, mathematicians tell us that the chance of any particular figure being hit in a special case is as one to infinity. Indeed the probability is that the profit on coal has been a good deal less than 8 per cent.; for, as we have already seen, every reasonable scale of rates is calculated on the basis of letting off bulky goods of small value as lightly as possible, and looking to high class traffic as the main source of net revenue. To ascertain with any degree of accuracy the approximate cost and profit on any particular traffic is a laborious and difficult job, and to ascertain it with absolute accuracy is a simple impossibility. There is another point: The net profit made by carrying any particular traffic is a function of the volume of that traffic. Now the coal owner, if he behaves like other coal owners who complain to commissions, will undoubtedly claim that the unreasonable rate results in stifling his potential traffic; that is, that, if the rate were reduced, his traffic would largely increase. In other words, his claim really is that, if the railway company only knew its business and reduced rates, their profit, so far from falling to 6 per cent., would rise to 9 per cent. And then the unfortunate commission would have to decide on a further and more sweeping reduction, and so on *da capo*. In fact, the problem, "given that a dividend of 8 per cent. should be reduced to 6 per cent., what individual rates should be reduced and by how much?" is as insoluble as the old conundrum of our nursery days: "Given the tonnage of the ship and the number of the crew, to tell the captain's name."

But this is not all. It is quite easy to talk about limiting the company's profits to 6 per cent., or any other figure, on the fair value of the property. It is safe to say that a man's readiness to pronounce what a fair value is, is likely to be in inverse ratio to his knowledge of the subject. I must not attempt even to begin to discuss the innumerable variations that may be included in the phrase, "fair value." They range all the way from actual cash, honestly and intelligently expended on the property for capital purposes—though why a railway man alone among fallible mortals should be expected to be endowed with unerring judgment and impeccable virtue, it is difficult to conceive—through "reproduction cost" and "value as a going concern," up to "market valuation,"—each quite different from the other, most of them varying from day to day, and none of them precisely ascertainable. As for market valuation, it is sufficient to say, for example, that the valuation of the Pennsylvania Railroad, as a going concern, paying a 6 per cent. dividend, is one thing today and would be quite another thing tomorrow, if a bill limiting its dividend to 6 per cent. were introduced and passed by the State legislature. But even this is not all. Assuming, for the sake of argument, that it were possible to fix rates on an individual railway, with some reference to a maximum permitted dividend on an ascertained fair value of the property, what is to happen when two railways, each with quite a different fair value, quite a different operating cost, and quite a different burden of honestly incurred indebtedness, come into competition? That the Denver & Rio Grande, carrying over a difficult road, through the gorges of the Rockies, might have to take lower rates than the Union Pacific, in order to induce traffic to use its inferior road, one can understand. But it is impossible to conceive that anyone would pay more. To cut down the rates on the Union Pacific, therefore, to a point which would only permit that company to earn 6 per cent. as a maximum, means, in fact, to cut down precisely to the same extent the rates of the Denver road, and to condemn the Denver to all time to a lower scale of profit. Indeed, it would almost seem to be necessary, as some ingenious person has, I believe, suggested, that the Government should permit the strong road to earn more than its 6 per cent., but require it to hand over any surplus above that figure as a grant in aid of its weaker competitor. It requires, however, a strong belief in the superiority of railway men over ordinary frail human nature to believe that under such a policy, or indeed under any system of limitation of dividends, a surplus would long continue to emerge at all.

The assistant chief engineer of the Szechwan-Hupeh Railway, China, states that 50,000 coolies are now at work on this line. Eighty-five pound rails are employed for the main line, using 13 ties to the rail. Construction trains are running twice daily between the Ichang wharf and the track end, a distance of about 6 miles. More than 40 ballast cars are now in use carrying materials. With the exception of two cuts, the track could be laid some 20 miles. The Ichang station building is finished up to the roofing, and will be soon completed. The three storerooms are already occupied, the locomotive sheds built, and the head office building fairly started. Near the station are two 22-ft. wells, while the water tower will soon be completed. The coal yard is under construction. Four shafts have been sunk at the 6,200-ft. tunnel, 50 miles from Ichang. The presence of water renders the work difficult. Two 1,000-ft. tunnels are under way 25 miles from Ichang, and one 700 ft. long, about 15 miles from that city, is completed. The equipment for the machine shop, ordered from a German firm, has arrived and will shortly be installed in the newly built workshop. In order to secure more satisfactory transportation from Hankow to Ichang, another 500 h. p. tug and two 200-ton lighters have been ordered from a Shanghai engineering company. From the American Bridge Company, New York, eleven 100-ft. spans have been ordered. Two million superficial feet of Oregon pine logs and planks have also been contracted for.

THE APPRENTICE SYSTEM IN THE STORE DEPARTMENT.*

BY N. A. MEARS,
Storekeeper, Lake Shore & Michigan Southern.

On most roads, the store department has been made up of the likeliest young men of the locality, many of them without any higher education than part of the grammar grades, and secured by the weeding out process of holding and promoting the proficient common workmen about the shops and storehouse. The personnel of this association shows that the selection, in most cases, has been a wise one.

But with the coming of foreign labor on the railway, and the better education of the present times, we find that the best of the young men start with other employment, or go to it after a short stay in the store department, because the immediate scale of wages is somewhat higher, not looking ahead to see the opportunities which certainly are open to a man qualified in the store department work.

It is a common practice for a young man to put in an application for apprenticeship in the mechanical department and then seek employment in the store department at 16 cents to 18 cents per hour, which he gladly quits when the opportunity comes for him to start his assured apprenticeship at 7 cents per hour.

A young man will rise in a store department for a year or two, by studious application and the opportune vacancies just ahead of him, till he stops just high enough in the department to see that with all his knowledge he has only covered one-half or perhaps one-third of the foundation details that would make him eligible to further promotion. In order to keep in line he has to go back and familiarize himself with them. At this time he has about all the duties he can perform, and may even be putting in some overtime to keep an eye on the job ahead. As he realizes his position in the organization, the chances are ten to one he will take the first position that may be open to him, where he may make a little more money, even though he has to leave his place that he has worked up the line to hold.

And we find since we have acquired the foreign labor that there are less of these fellows available, who have, perhaps a small education, but lots of horse sense, and we have to do our best with the foreign laborer or the school boy just past the age limit allowing him to work.

There is quite a gap between these boys, usually office boys or messengers, and the place where we could use them as stockmen, shippers, etc., and to get them there I propose the apprentice system.

To get the best out of this system the head of the department should pass on each apprentice and know by card record his character, originality, executive ability, application and general deportment. He should guide the apprentice through his education by lectures, examinations and promotion after proper length of service, other points considered.

To outline an apprentice system in detail requires considerable local knowledge of the department to which it is to be applied, but I believe a general plan could be made up, even to rates for positions, and this outline would help us all in starting a system that would give the desired result.

For instance—the start might be made at office boy; to retail boy or shop messenger; next, caseman or storehouse helper; helper in the receiving or shipping departments; back to the office for experience in the requisition department; invoice work, and file and statement work. Then some time on the supply car, and by this time the boy or man will be ready to assume the first position of actual responsibility as stock clerk or assistant foreman. At this time, by carefully regulating the length of time spent in each branch of apprenticeship, the rate of pay at the start, the proper graduation of the increase in rate and responsibility, the apprentice is getting enough money to warrant his staying in the department. He also has experience to make him available for any position that may open and to make him feel that he knows enough about the positions ahead to expect them as they open and fill them with credit when promoted to them.

It may appear that an apprentice system would increase the payroll, but by reduction of present rates to make the starting rate low enough, an equal amount will be gained to increase the present rates for higher promotion or may even allow some saving. When you consider the cost of two or three hundred dollar men spending several hours in straightening out some inexperienced employees' mistakes, even an increase in the payroll on certain rates might cause a decrease in actual expenses by putting such wasted time on its proper work or even reducing the number of rates. And it is bound to reduce the grief and keep the organization ready at all times to properly handle the current work. Even an entire increase in the payroll would be warranted with the increased efficiency gained by having these properly educated men handling all branches of the work, minimizing the time lost in correcting errors.

This will result in getting the right kind of young men to start, having properly educated and experienced help on all classes of work and make an organization that can be depended upon. It will also do away with the large amount of unaccountable and annoying daily errors, which occur where we are doing the work with men who are only looking for pay day, and are replaced so often that it is almost impossible to keep them properly instructed or watched, to obtain the proper results.

*From a paper read at the meeting of Railway Storekeepers' Association, May 22.

STANDARD MATERIAL CLASSIFICATION AND DISBURSEMENT.

BY H. C. STEVENS,
Superintendent of Stores, National of Mexico.

In summing up for comparison of store department efficiency as between different roads, two important units are usable, the cost of handling, and the quantity of the stock carried as compared to monthly issue.

Under the present rules of the Interstate Commerce Commission, the first is now fairly comparable. Difference in this is generally governed by supervision, management of men, or mechanical facilities. If it is either of the first two the management wishes to know it. If it is in the latter, it should by all means be plainly before the management for full consideration in connection with possible additional facilities.

Were one to attempt a comparison of the second unit between roads, an investigation into the details comprising the figures as now available would at once convince him of the impossibility of a true comparison. Why is this? Simply because of lack of unity in methods. A few years ago the cost of handling was fully as incomparable; some roads omitted salaries of some officers and others certain portions of the labor, which other roads included. The rules of the Interstate Commerce Commission have changed this, so all are including practically the same items to cover this expense.

Shall we wait for the Interstate Commerce Commission to similarly formulate regulations covering the classifying and disbursement of railway stocks, or will the officers of the railways through their store and accounting department associations, promulgate and adopt a suitable method, which, after bearing the approval of the commission, will be universally placed in operation?

Such a practice would unquestionably bring valuable results in more channels than the one of affording comparison between roads. Men handling material accounting on one road would be familiar with the general routine covering the same feature of work on another road. There would be many men thinking and

*Paper read at the meeting of the Railway Storekeepers' Association, May 22.

working towards the improvement of one general plan, and a simplification in detail method or device in connection with the work on one road would be interesting to and could be beneficial to the other roads. At the present time, something which enables one road to get the final result in half the time and at less expense than previously secured is very probably of no use to another road, on account of the vast difference in method.

It is only a step further along the line of common standards, such as started by the M. C. B. and M. M. associations some years ago in connection with materials and devices, and furthered by the Interstate Commerce Commission in its regulation of accounting principles and practices.

For the uniform method by which the desired result must be accomplished, we can rely on a joint committee of the Storekeepers' and the Accountants' associations, with a representative of the Interstate Commerce Commission, each road to work out its own details. The important features are a careful grouping of the different classes of material, to be blended as closely as possible with the accounts to which generally disbursed, and a clear outline as to methods to be followed in the disbursement of and charges for material.

The reports of the store departments of some roads now include all materials, even stationery, while on others rails, ties, stationery and some other items are omitted, as they are not handled by the store departments. The grouping should be clearly segregated with this in mind, each final report to be on the group basis, so comparison can clearly be made one road with another to the extent to which each handles the same material irrespective of the groups which may be handled by one and not by the other.

On some roads scrap is not taken into stock until actually sold, when the transaction of debit is offset by full credit, showing a 100 per cent. issue, while in others it is taken into stock in the month in which it accumulates, regardless of when sold. Undoubtedly good practice is to take it in regularly, to avoid fictitious fluctuations in monthly charges and credits; but, regardless of which is preferable individually, one only is the better generally, and should not all follow the better general practice than the individually preferred practice?

Some of us are now charging material to the accounts when it is drawn or is on the ground for use regardless of when it will actually be used, while others are not charging it until it is reported actually used, or is taken from stock at the seat of use for immediate application. The first has the disadvantage of material frequently being transferred from the use for which drawn and applied for the benefit of some other work or account and no accounting made thereof; while to either of the latter there is no doubt attached some additional clerical expense. It is generally thought, however, that one of the latter will ultimately prevail on all roads so that all work will be charged positively with only the material used therein, and to accomplish this, no doubt some additional clerical expense is warranted.

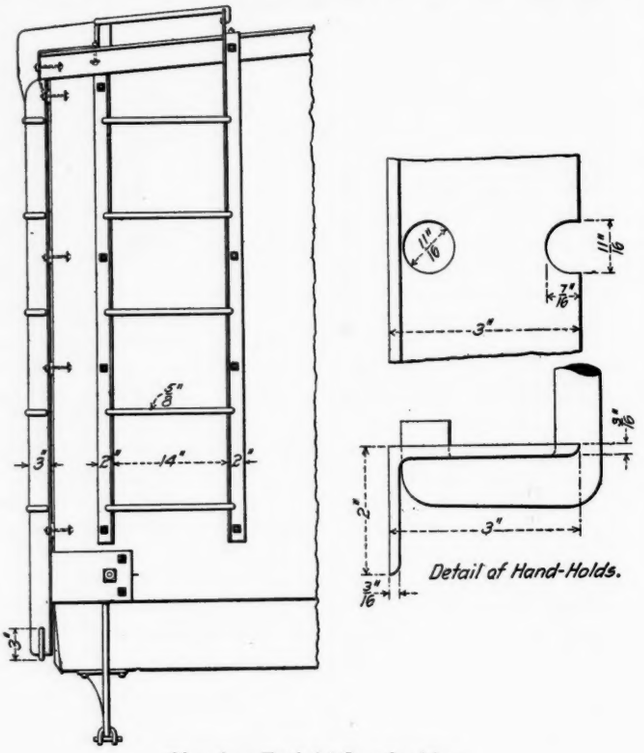
This is not intended, however, to designate the method. Let the method be whatever is concluded to be best, but when that concluded, let us see that it is uniformly followed, so that our general officers can have a true comparison of our actual operations, irrespective of the policies of our individual managements as to carrying large or small stocks, and instead of having a regulation forced upon us have a practical one of our own making which will meet the approval of the body which will no doubt prescribe for us in the next few years if we do not in the meantime cure ourselves.

It is to be hoped that the expressions of desire along this line from the general officers will be such as to insure conclusive action by the bodies above referred to within the next year or two.

The section of the railway from Alcones, Chile, to Pichilemo, comprised between Alcones and El Lingue, has been delivered to the state railways for exploitation.

THE SIMPLEX SAFETY CAR LADDER.

The Texas & Pacific and the Texas Central have ordered some of their freight cars equipped with iron ladders, designed and patented by M. F. Saling of Dallas; and we are informed that both of these roads have decided to make this design standard for their freight cars. Mr. Saling informs us that he is negotiating with a number of other large roads. The ladder consists of rungs made of 5/8-in. round iron, which are supported in vertical angle irons bolted to the side or end of the bar. The rungs are bent over and inserted into holes in the projecting part of the angle iron from the outside, so that when



Simplex Freight-Car Ladder.

the vertical pieces are fastened in place they hold the rungs firmly in position without bolts, rivets or welding. The upright bars are 2 in. x 3 in. x 3/16 in. The sill step and the hand-hold on the roof are fastened to the angle irons in a similar manner.

Mr. Saling informs us that the cost of this ladder is about the same as that of other designs made of metal, and will last through the life of several wooden cars. The engravings show a front elevation of an end ladder and a side elevation of a ladder on the side of a car, they also show the manner in which the rung or hand-hold is connected to and supported by the angle bar.

The British Government has a railway 227 miles long in Sierra Leone, extending from the coast at Freetown eastward nearly to Liberia. Parts of it have been in operation for ten years. Palm nuts are the chief freight down. Oil is made from the nuts and soap is made from the oil; for which, however, the local demand is insignificant. To facilitate loading, a special place for each station is set apart in the freight house at Freetown, and shippers are required to unload their goods accordingly. As their porters have the usual African education, which as yet does not include the alphabet, the space for each station has a distinct color; and when the shipper wants the porter to ship a keg of rum to Lago, for instance, he tells him to put in the "blue" bin, and he understand as well as if he had studied Greek.

Shop Section.

WE have sent announcements of the competition on how scientific management can be applied to a railway shop to a number of efficiency engineers and expect that some of them, at least, will take the opportunity of demonstrating whether it has any practical application to railway shop practice. From the general discussions which have taken place—varying all the way from the laying of bricks to the efficiency of a fire fly—its application to the locomotive or car repair shop is not very apparent, and we feel that a little more light should be shed on this particular phase of the subject. As judges in the contest we have been fortunate in securing three mechanical department officers who have proved more than ordinarily successful. They are H. H. Vaughan, assistant to the vice-president of the Canadian Pacific; G. W. Wildin, mechanical superintendent of the New York, New Haven & Hartford, and T. S. Lloyd, superintendent of motive power, Delaware, Lackawanna & Western. A prize of $50 will be awarded for the best article and one of $35 for the second best. Such others as may be accepted for publication will be paid for at our regular space rates. In accordance with a suggestion made by one of the efficiency engineers, the manuscripts should be unsigned but should be sent to the editor with a letter, the letter and manuscript to be numbered by the editor and the manuscript to be forwarded unsigned to the judges.

RECLAIMING scrap material will be the subject of the competition to close July 15. This offers one of the most attractive and interesting subjects which has as yet been announced in our series of shop competitions. Hardly any two roads are working along the same lines in this most fruitful field for economy, but practically all of them are doing something, and many of them a great deal. What is being done at your shop or repair plant? Tell us about it fully, explaining just how it is done and what the possible savings are. Like a great many things, the reclaiming of scrap can possibly be carried too far. What are your ideas about the limits to which it may be extended? More complete announcements of this competition will be found in the April and May Shop Numbers. The best article will be awarded a prize of $35 and the second best a prize of $20. Articles not awarded a prize, but accepted for publication will be paid for at our regular rates.

ANOTHER general shop kink competition will be held to close September 15. Kinks of any kind used in the repair or maintenance of locomotives, cars or other mechanical department equipment will be eligible. Do not make the description so meager that the judges and editor will have to use their imaginations to fill in the details. Remember that the design of the piece which the kink is used on may be peculiar to your own road or shop and hardly be intelligible to outsiders. We have been asked to make our descriptions more extended. We can do it, if you will help us. A prize of $50 will be awarded for the best collection of three kinks and a prize of $25 for the next best collection. More than three kinks may be submitted, allowing the judges to base their decision on the best three in each collection. Kinks not awarded a prize, but accepted for publication, will be paid for at our regular space rates.

C. C. LEECH, foreman of the Pennsylvania Railroad, Buffalo, N. Y., was awarded the first prize of $50 in the shop kink competition which closed May 15; and H. S. Rauch, apprentice instructor of the New York Central & Hudson River, Oswego, N. Y., was awarded the second prize of $25. Eight collections of shop kinks were submitted, all of them exceptionally good, and the judges found considerable difficulty in selecting the winners. In doing this consideration was given to the fact that some of the kinks which were submitted were quite similar to kinks which had been published in previous Shop Numbers. The remaining six contestants were: H. L. Burrhus, assistant to general foreman, Erie Railroad, Susquehanna, Pa.; E. L. Dudley, special apprentice, Baltimore & Ohio, Cleveland, Ohio; E. F. Fuller, shop superintendent, Southern Railway, Spencer, N. C.; William G. Reyer, general foreman, Nashville, Chattanooga & St. Louis, Nashville, Tenn.; W. H. Snyder, assistant general foreman, New York, Susquehanna & Western, Stroudsburg, Pa.; and W. H. Wolfgang, draftsman, Wheeling & Lake Erie, Toledo, Ohio.

BECAUSE so much has been said about the wonderful results obtained in the works of The Tabor Manufacturing Company, of Philadelphia, Pa., due to the introduction of the Taylor system, we reproduce elsewhere in this issue part of an article prepared by Mr. Lewis, its president, both as a matter of interest and because our readers may find some practical suggestions in it. It may be interesting to know the reason for introducing the Taylor system, in Mr. Lewis' own words: "At the same time we knew that machines had been built by others for less than they were costing us, and we felt confident that a way could be found out of our difficulties." It would be uncharitable to say that apparently the type of management formerly in existence was so bad that almost anything would be an improvement, and we shall not do so. The Tabor Manufacturing Company is a comparatively small concern, so that there should have been a fairly close bond between the workmen and those in charge, and yet Mr. Lewis frankly admits in the first part of the article, which is not reproduced, that it was a hard fight to install the new system. In a larger concern, the fight might have proved hopeless. Nor is any evidence presented to show that it is paying its men more or actually increasing its net earnings over that of other companies in a similar business and with fewer scientific methods are doing.

MR. BROMBACHER, the author of the article on Comparing the Efficiency of Railway Shops, would undoubtedly feel very badly if he should be classed with some of our leading efficiency engineers. For instance the methods of Taylor or Emerson would probably not meet with his approval. He believes in piece work—where it is properly installed—and cites the methods in use on the Lackawanna as being more or less ideal. We cannot altogether agree with him that reforms must come from the outside. Railway mechanical men realize that in many instances piece work methods are not what they should be—possibly due to conditions existing at the time they were installed or because piece work on some roads was or is in the hands of men who are not big enough to handle it. It is also a matter of sincere regret to find the accounting or auditing departments insisting that exceptional workmen, who can earn more than $4 or $5 a day, are overpaid and that the prices are too high. Again, it reflects a serious condition when the workmen keep young men from trying to exert their best efforts, because if they go beyond a $4 a day rate the price will be cut —for the men had found by bitter experience that that limit had been placed on their earnings by the management. Fortunately this practice is the exception, not the rule, and it is quite possible that piece work when so administered is not much of an improvement, if any, over day work. Under such conditions it is not piece work and really does more toward encouraging soldiering than do day work methods. However much our

good friends, the efficiency engineers, may criticize the lack of initiative on the part of the worker, they certainly cannot accuse him of being dull. Usually he is quick to appreciate and imitate the methods used by his employer. If he realizes that his employer is playing fair and is willing to pay a fair compensation for work done, and really knows what a day's work is, he will be entirely reasonable if a readjustment of prices is found necessary. One railway, in a territory where labor conditions generally are supposed to be anything but good, has recently revised a fair proportion of its piece work prices—many of them downward and without the addition of improved machinery—but the men are contented because they have been shown carefully why the prices were too high and exactly how by closer application and with very little more effort they can equal or increase their earnings under the former prices. The views of Mr. Brombacher, as an outsider, are interesting. It is really somewhat refreshing to have an efficiency or production engineer say something that has so little of the theoretical and so much of the practical in it.

THE reference in the article on Comparing the Efficiency of Railway Shops to what is designated as "ticker management," is not new to most of us. Laying off men by the hundreds or thousands to make a showing for the annual report is a losing proposition if there is work to be done, which a little later will cost a great deal more to perform, because the defects have become aggravated by not being promptly attended to, or because increased traffic, which could have been clearly foreseen, requires the work to be done under pressure, and consequently at a greatly increased cost in many cases. Truly, a short sighted policy, which is far-reaching in its results, affecting, as it does, the prosperity of the cities and towns on the system and the allied industries. If the executive officers or boards of directors could understand what it actually costs to tear down an organization for a few weeks or months and build it up again, they would surely not allow it. Have they been shown the cost? It should not be difficult to calculate it, at least approximately, by reducing it to the basis of unit output—such a unit would depend largely on the equipment handled, but could be arrived at by a careful study of the records and the work performed.

IF the makers of oxy-acetylene welding and cutting apparatus were looking for frank criticism they certainly got it in the discussion at the May meeting of the New York Railroad Club, when Prof. J. M. Morehead presented a very complete paper on Acetylene Welding. The main trouble seems to have been that the representatives of some of the companies rushed in to demonstrate the merits of their apparatus, when it was first introduced, without properly appreciating what they were up against. In other words, they attempted to demonstrate how easy it was to do certain things and failed miserably—at least so it appears from some of the remarks at the meeting. Undoubtedly most of these fruitless demonstrations were made some time ago in the early stages of the development of the apparatus in this country. The experience of several roads which are using it extensively at the present time certainly indicates that there is a broad field of usefulness for it in locomotive and steel car construction and repairs. That it has its limitations in the present state of the art must also be admitted. Prof. Morehead emphasized the necessity of the establishment of schools at which instruction could be given in the use of the oxy-acetylene torch. There are several such institutions in Europe. The courses cover only a month or two, during which time an average man can become more or less thoroughly conversant with the general run of work. Judging from the successful work covering a wide range of subjects which is being done by different railways it hardly seems possible that the statement which he made that 90 per cent. of the good welders in this country were in the room when he spoke, could have been intended as strictly accurate. If they were, they were not very aggressive or they would have come to his aid in the discussion—not that he really needed much aid for single-handed he made a good fight, even if he did not know whether a locomotive frame was made of cast iron or brass. That the oxy-acetylene welding and cutting process is giving a good account of itself in locomotive boiler shop work is indicated by the discussion of the subject at the Master Boiler Makers' Convention, an account of which will be found on another page of this issue.

FROM the report of the Master Boiler Makers' Association, given in abstract in this issue, it will be seen that the reports of the committees and the discussions on the floor were of a thoroughly practical nature. No attempt was made to go into the theories of boiler work, other than to determine the reason for the various phenomena that arose in practice and to devise means for overcoming such as are injurious. One feature, especially noticeable throughout the whole convention, was the close adherence of the members to the subject in hand; in this respect the proceedings show a marked improvement over those of a year ago, and cannot fail to be of value not only to the members, both present and absent, but, if they are carefully reviewed, will be full of suggestions to those officers who have the care of the locomotives and the operation of the road in hand. Particular attention is directed to the consensus of opinion among these men that bad water is responsible for the great majority of the troubles with locomotive boilers, such as leaky tubes, cracked sheets and the like—a point on which it is expected to present further information in the near future. The proceedings are, therefore, earnestly recommended to the careful consideration of all who have to do in any way with the locomotive boiler.

THE STABILITY OF LOCOMOTIVE YARD CRANES.

THE locomotive crane as used on yard tracks is being widely introduced and adapted to a variety of purposes where it is proving a most economical machine for handling heavy and bulky materials. It was first used about locomotive shops as a hand crane for lifting tires, driving wheels, axles, frogs, etc., and it gradually made its way into the stores department, where it was usefully employed in handling heavy scrap, lumber, castings and forgings. In time it proved desirable to operate the locomotive crane by steam power, and its capacity and range were thereby greatly enlarged. The application of the clam shell bucket made it available for handling coal and ashes at locomotive terminals, and the electro magnet in connection with the locomotive crane has effected remarkable economies in handling iron and steel in almost every form. These qualities have become so widely recognized that the locomotive crane is now in use on nearly all railways, and the number employed is growing rapidly.

Experience with these cranes thus far has shown that their stability can be relied upon under ordinary conditions, and where carefully handled, but they are sometimes liable to be overloaded, or are operated so rapidly that they are unbalanced and turned over with occasional personal injury or fatality. The balancing of this type of crane has not been standardized as to the location of the center of gravity or to the capacity with reference to various radii of swing, and there is some confusion among different crane builders as to the meaning of the figures used for guaranteed capacity through various ranges of swing.

To prevent overturning there must be some margin above the rated maximum capacity at any given radius; that is, if a crane is in equilibrium or just on the point of tipping with a load of 12 tons at 12 ft. radius, its guaranteed capacity should be stated as 10 tons at the same radius, thus allowing a margin or factor of safety of 20 per cent. With some builders this factor of safety is much less than 20 per cent.; perhaps only 5 or 10 per cent., and with others there is no margin. This is one of the items upon which there should be some general

agreement with the object of establishing a uniform standard for the guaranteed capacity.

Again, this type of crane must not be balanced too far to the rear, or there is liability of the crane tipping backward when on a sharp curve with the elevated rail on the same side as the load to be lifted and the boom released from the usual working fixtures. To prevent this the center of gravity of the whole crane should be 9 in. inside the outer rail, that is, the rail nearest the counterbalance.

The capacity of these cranes is usually stated as a certain lift at a radius measured between the center of the load and the center of the crane pivot post. But the moment tending to overturn the crane has a lever arm measured from the center of the load to the center of the rail, and the latter is about 2 ft. 6 in. from the center of the post. This distance should, therefore, be deducted from the radius in order to get the lever arm about the center of moments.

To illustrate the confusion in some guarantees for locomotive cranes, we may take the following from the catalog of one of the prominent builders: "A capacity of 5 tons at a radius of 30 ft., or a capacity of 10 tons at a radius of 20 ft." The load of 5 tons at a radius of 30 ft. acts with a lever arm of 30 ft. — 2.5 ft. = 27.5 ft., and 5 tons × 27.5 ft. = 137.5 foot-tons, the moment tending to overturn the crane. Again, 10 tons at a radius of 20 ft. acts with a lever arm of 20 ft. — 2.5 ft. = 17.5 ft., and 10 tons × 17.5 ft. = 175 foot-tons, showing that if the capacity at a radius of 30 ft. is correct, then the load for a 20-ft. radius, as given in the catalog, is too great and would hardly be safe.

In some instances irresponsible workmen have sought to extend the range of activity of their cranes by lengthening the boom and not reducing the load in proper proportion. This has sometimes resulted in accidents and should suggest methods of safeguarding this kind of machinery. The manufacturers should be interested in establishing these standards for capacity, as well as safety, but as they do not seem to realize their importance, the railways could perform a useful work through the Master Mechanics' Association in getting a committee report on the stability of locomotive yard cranes, with reference to their rated capacity and their safety.

MECHANICAL ARTICLES DURING MAY.

THE following articles of special interest to mechanical department readers, and to which Shop Number readers may wish to refer, have appeared in the weekly issues of the *Railway Age Gazette* since that of May 5:

The Supply Department. E. J. McVeigh, storekeeper of the Grand Trunk, does not agree with the type of store department organization advocated by H. C. Pearce, in a series of articles which recently appeared in this journal, and outlines what he considers to be a more effective organization. May 12, page 1103.

Federal Boiler Inspection Rules. A set of rules, agreed upon by the chief inspector of locomotive boilers and his assistants and a committee of railway mechanical department officers, giving the minimum rules and instructions for the inspection of locomotive boilers. If approved by the Interstate Commerce Commission, after a hearing which was held May 29, they will be obligatory upon any carrier failing to file its own rules and instructions. May 12, page 1105.

Chicago Great Western Locomotive Terminal at Stockton, Ill. A 12-stall brick engine house, a 90 ft. turntable, a reinforced concrete cinder pit and a concrete oil house are illustrated in the issue of May 12, page 1108.

International Railway Fuel Association. An account of the first part of the recent convention at Chicago, with abstracts of several of the papers which were read and the discussions which took place, including one on Fuel Investigation by the Government by Dr. J. A. Holmes, Organization of a Railway Fuel Department by T. Duff Smith of the Grand Trunk Pacific, and Purchasing Coal on a Mine-Run Basis by Prof. A. A. Steel. March 19, page 1149.

Comparative Tests of Mallet Locomotives; Norfolk & Western. Two types of Mallet locomotives of about the same tractive effort were received by this road last year. Exhaustive tests have been made as to their efficiency. A complete account of the results appears in the issue of May 19, page 1153.

The Operation of a Mechanical Stoker. An editorial drawing attention to the fact that the fireman has been taught to believe that failure to keep up steam is an unforgiveable sin. The mechanical stoker operates so easily that the tendency will be to use more coal than necessary and the fireman will have to be carefully educated in the matter of fuel economy. May 26, page 1192.

The Street Locomotive Stoker. An extensive description of this stoker which is now in service on the St. Louis & San Francisco; Atchison, Topeka & Santa Fe; Lake Shore & Michigan Southern; Norfolk & Western; New York Central, and Pennsylvania. May 26, page 1196.

The Railway as a Manufacturer. Abstract of a paper by George G. Yeomans, assistant to the president of the Wabash Railroad, which was presented at the recent meeting of the Railway Storekeepers' Association. May 26, page 1205.

Coal Briquetting Plant. Illustrated description of one of these plants by Charles T. Malcolmson. May 26, page 1206.

International Railway Fuel Association. Abstracts of papers and discussions on Testing Locomotive Fuel by F. O. Bunnell, engineer of tests of the Rock Island Lines; on The Relation of the Fuel Problem to Railway Operation by Raffe Emerson; and on The Use of Oil as a Locomotive Fuel by Eugene McAuliffe, general fuel agent of the Frisco Lines. May 26, page 1208.

Air Brake Association. Abstracts of papers and discussions on Leather Packings and Cylinder Lubrication by H. A. Wahlert; Braking Power on Freight Cars by John P. Kelly, and Triple Valve Lubrication by Lincoln Leonard. May 26, page 1212.

NEW BOOKS.

Machine Shop Primer. By Fred H. Colvin and Frank A. Stanley, associate editors of the *American Machinist*. Published by the McGraw-Hill Book Company, New York. Cloth, 6 in. x 9 in., 148 pages, 508 illustrations. Price, $1.00.

The object of this book is to provide a handy reference for students, instructors and apprentices who deal with the subject of machine work. It is a primer in the true sense of the word, and is to the beginner of machine work what the spelling book is to the child. The book is divided into three sections: The first part contains 508 numbered sketches of articles and tools pertaining to machine work; the second gives the names of these articles, and the third contains a dictionary of shop terms and explains the uses of the articles shown in the first section.

Letters to the Editor.

SAFETY APPLIANCES.

WILKESBARRE, Pa., May 8, 1911.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

I have read with interest Charles L. Alden's article on Safety Appliances on page 1061 of the *Railway Age Gazette* of May 5, 1911, and his criticisms on freight car equipment relative to safety devices are particularly interesting to me. He states that 70 per cent. of the defects in the uncoupling device are due to the chain, and refers to the clevises as largely contributory. I can hardly agree with him that the chain, as a chain, is responsible for these defects, but unhesitatingly insist that the manner of applying the chain, as generally followed by many roads, has all to do with this condition. Clevises, split-links; links of all kinds as to length, size and material, etc.; and most of all the condition of this bungled-up mess of stuff called a chain being attached to a finger of the rod proper is the main cause of inoperative uncoupling devices.

The remedy for this crying evil is not in the elimination of the chain, but lies in the mechanical application and the elimination of the senseless number of parts, such as clevises, split-links, etc., and connecting the chain with a fixed body, such as the endsill or end of the car proper, thus insuring uniformity of length of chain under all conditions—not attaching it to a flexible finger as is the present practice.

A proper uncoupling mechanism must satisfy the following requirements: A uniformly operative device in lifting the pin and opening the knuckle; catching the coupler head if broken, by releasing the knuckle; and preventing the pin or lock block from working up, causing a break-in-two emergency stop; and most of all, a device so operated that trainmen's lives are not endangered in its operation. None of the lever types will perform these functions satisfactorily, because of their rigidity under abnormal conditions, which exist more or less of the time on all equipment.

J. G.

COMPARING THE EFFICIENCY OF RAILWAY SHOPS.

BY MAX H. C. BROMBACHER.*

The items in the annual reports of railways to the Interstate Commerce Commission, which refer to the number of miles that locomotives, freight cars and passenger cars have traveled during the year, are supposed to be calculated in compliance with the rules and regulations laid down by the Commission. The reports give the amounts of money expended on each of these three items; they also summarize the results by stating the cost per mile run for each of these items for the year. It would seem that the costs per mile run afford a substantially fair basis for the comparison of the relative efficiency of the managements of the various roads, subject, of course, to differences in grades and curves on the different roads, and also to differences as to the standards of maintenance of equipment, and to the amount of mileage.

In a recent article in which the figures were taken from reports issued by the Interstate Commerce Commission, the writer gave this data for the roads in the Eastern Traffic Association for the year ending June 30, 1910. The Delaware, Lackawanna & Western has as stiff grades and curves with as small a mileage as any road in this territory, and at same time maintains its equipment up to a standard second to none. Its costs of 6.76 cents per locomotive mile and of 0.60 cents per freight car mile were used as the basis of a computation of the amounts of money which the roads in the Eastern Traffic Association could save by raising the efficiency of their repair shops to the level of those of the Lackawanna.

This computation, therefore, was not based on the installation by the other roads of what has been called "scientific management" or "efficiency methods"; nor upon the engagement by the roads of Mr. Brandeis or any of the engineers who are so insistent in their objections to ordinary methods and to piece-work practice. With all respect to these gentlemen, their motives and their attainments, the writer considers that the success of their idea of efficiency methods is problematical at best, as far as it concerns railway repair shops. A careful reading of some of the papers on that subject presented at the recent Congress of Technology at Boston, tends to confirm this belief. Wherein do these efficiency methods have any advantage over really intelligent piece-work practice; that they have advantages over ordinary or typical piece-work practice, cannot well be denied by anyone conversant with such practice. The computation above mentioned was based upon the different roads adopting the piece-work practice in vogue on the Lackawanna, which had previously succeeded in producing concrete results and for a period covering several years. The piece-work practice in the shops of the Lackawanna is a comparatively modern conception, and is as different from the ordinary or typical piece-work practice, as day is from night.

As a result of the publication of the above-mentioned computation, it has been brought to the writer's attention that at least one road could not make the figures published by the Interstate Commerce Commission for the year in question, agree with its own figures as to the costs per mile run, and inferentially of its mileage; hence it would seem that an error had crept in somewhere. Perhaps this road reported more mileage than the Interstate Commerce Commission could credit it with under the regulations governing that subject; this would account for its lower figures as to the costs per mile run. The same road objected to the difference between its costs per mile run and those of the Lackawanna being considered as any fair measure of the difference in efficiency of the management of its repair shops; it seemed to consider such a basis of comparison as being misleading, and the conclusions based thereon to be erroneous.

While comparison on the basis of the cost per mile run is certainly not a flawless one, it is a tolerably fair one. As regards the objecting road, the comparison is more than fair to it; this road has nothing like the Lackawanna's grades and curves to contend with, nor does it keep its equipment in any better condition, and it has a very much larger mileage. It would seem as though the comparison was unfair to the Lackawanna—if unfair to anyone. There is no doubt that, among railway men, there is a difference of opinion as to whether the cost per mile run is a fair basis of comparison as concerns the relative efficiency of the management of repair shops. Some say it is unfair, because conditions are very different as regards the shops of one road and those of another; others claim that the cost of repairs per ton mile hauled would be a fairer basis.

If "conditions being so very different" precludes the cost per mile run from being used as a fair basis of comparison, it would seem that no fair basis of comparison could be found; certainly the cost of repairs per ton mile hauled is not flawless as a basis of comparison. If the engine is not loaded to its maximum point of efficiency the comparison is not fair, since the weight of the engine is a factor in the cost of repairs. Similar objections would be cited in respect to tractive effort as a basis of comparison. The writer published some piece work prices a short time ago which were taken from data furnished to the Interstate Commerce Commission by the railways. It would seem that the differences in prices for identical operations would account very fully for most any difference in the costs per mile and it seems unnecessary to look further for reasons to account for differences in this respect. These very differences in piece work prices afford some basis for comparison of the relative efficiency of the different managements of repair shops.

When the statement that "conditions are so very different," is looked into as an objection to the fairness of the cost per mile run, as a basis for comparison, it is very soon discovered to be a case of conditions for whose existence there is no reason compatible with sound economics. If the statement that conditions are very different be offered as the explanation for differences in piece work prices of from 5 per cent. to 500 per cent. on identical operations, an investigation of the earnings per hour of the operators at these widely varying prices will soon disclose a relatively similar absence of sound economics as the real explanation for this unique state of affairs. In the last analysis, the explanation in both cases will be shown to be a case of difference in grade of intelligence and knowledge of the human equation possessed by the different managers of the various roads. Lack of knowledge of the human equation is by no means monopolized by the so-called school of efficiency engineers; any quantity of railway executives are afflicted with that lack.

The conditions which are referred to sometimes consist of antiquated equipment and tools. When these deficiencies are cited as the explanation for differences in cost of from $.28 to $1.20 in turning a pair of standard coach wheels, and of differences in cost of from $1.50 to over $5 for unwheeling and wheeling a consolidation locomotive, the conclusion of the unbiased investigator may be that these conditions justify these differences in piece work prices. That he will admit that such differences in piece work prices go far toward explaining differences in costs per mile run, is fairly certain; and that he will conclude that the very existence of such conditions with the attendant results is, in itself, a grave indictment of the efficiency of the management, is beyond reasonable doubt.

None of these instances are culled from the realms of imagination. Nor are they taken from roundhouses; no reasonable person expects the roundhouse to be equipped with the very last word in the way of tools or of equipment. They are taken from machine shops at division points; also the lower price for turning standard coach wheels does not represent the very last word in the way of wheel lathes; it represents results on a fairly modern wheel lathe. On the same road the most up-to-date wheel lathes make for a reduction of nearly 40 per cent.

*Practical Production or Efficiency Engineer, New York.

below the low price of 28 cents per pair for turning 36 in. coach wheels. This condition is no reflection on the master mechanic in charge of the shops in question; he may have asked for the necessary tools and equipment, and have had his request refused. One master mechanic gave as a reason for paying $50 per pair for turning 36-in. coach wheels, that the wheels supplied him were so badly shelled that instead of taking off ¼ in. he was often compelled to take off as much as ¾ in. before he got a clean surface. Upon being asked why he failed to reject such poor castings, he replied that he was not allowed to reject them. This of course worked a double loss—the higher piece work price, and a shorter life for the wheels.

This is not the only instance where shop managers have attempted to explain that conditions for which they were not responsible, accounted for the differences in piece work schedules; nor is it the only instance where, after being pinned down they had admitted that the existence of such conditions constituted in themselves an indictment of the efficiency of the roads' management of its repair shops. They know as well as anyone where the trouble lies. They may not know what the cure is in all cases, but many of them admit that, by and large, the cost per mile run, is a fair enough basis of comparison of the relative efficiencies of repair shop management. They know that the conditions which are offered in explanation of differences in cost per mile run, as also differences between piece work schedules, are, in the last analysis, chargeable to inefficient management on the part of their superiors, and to ignorance of the human equation.

The following basis of comparison might be a shade more conclusive and more satisfactory than the cost per mile run. However, it is not flawless by any means. It will enable one to show that the cause of underlying differences is a difference in the respective grades of grey matter possessed by the different managements, plus or minus a knowledge of the human element. It is not expected that it will eliminate "conditions" as explanations of comparatively high costs; but it is hoped that it will make it possible to place the responsibility for the "conditions" beyond a reasonable doubt. That it may disclose the cause of high repair costs, in some instances, as being due to "ticker management," is not wholly impossible.

The idea is to divide the locomotives on each road into classes according to weight; this is based on the weight of locomotives being a factor in the cost of their repair. Keep tab on the age at which new locomotives first require repairs; on the average amount of money spent on locomotives by classes per annum; also on the amount of ton-miles hauled between repairs; also keep a record of the aggregate number of ton-miles hauled by each locomotive per year. This would give, is at least intended to give, the following data: Cost of repairs per average locomotive per year for each class of locomotive operated; number of times which the average locomotive requires repairs per year in each class; average number of ton miles hauled between repairs on the average locomotive of each class; and average number of ton miles hauled per year per locomotive for each class of locomotive. Repairs to include both roundhouse and shop repairs, and the number of times the average locomotive in each class is repaired to include roundhouse and shop items. Not the least of the benefits which may reasonably be expected from the tabulation of these items is that the management may discover "the error of its ways" in respect to the policy it has been following. For instance, take the case of a road where the management will not permit a thorough job of repairs being done on a locomotive, but holds the cost down to what will not permit more than what might be called a job of "galvanizing." It will find that in a year it has repeated the "galvanizing" process a number of times at an aggregate cost considerably greater than thorough work would have cost, and yet the aggregate number of ton-miles hauled per year is less than is expected; and certainly less than thorough work in the first instance would have resulted in. This is not an imaginary instance.

It would seem that even "ticker management," ignorant as it is of the details of a railway repair shop, would thus be brought to a realizing sense of what that kind of management is bound to contribute to the cause of waste. It is beyond reasonable doubt that the presentation of results in this form would result in the adoption of a more intelligent policy and the saving of a lot of money; incidentally, both the cost per mile run, as well as the cost of repairs per ton-mile hauled, would be reduced, and one "condition" making for waste would be eliminated. If the Interstate Commerce Commission were to make a rule to this effect, stockholders would be put in possession of information which would be explanatory of much in the way of the reasons for differences in dividends between roads. That the making of such a rule by the Commission is by no means impossible, is clear from the statements of some of the commissioners immediately after their refusal to sanction the proposed increases in freight rates.

Certainly the outlook for the first road which renews its application for permission to raise freight rates will be an investigation of its methods of management. That the repair shop management is a very important factor in the net income applicable for dividends is shown by the fact that the difference between the Lackawanna's cost per mile run of locomotives and freight cars, and those of some other roads, would, worked out on the basis of the locomotive and freight car mileage of the other roads, have resulted in the saving of a greater sum, net, than the proposed increase of rates would have produced in increased gross revenue.

If the Interstate Commerce Commission investigates these matters, it will find that the great differences between piece work schedules for identical operations are a large factor in the differences in cost per mile run; and it will find that high piece work prices do not mean relatively (proportionately) higher earnings to the operators in the shops with the high piece work schedules. On the contrary, it will discover instances where, on a difference of 50 per cent. in the cost of a standard every day job, the operators earns 10 per cent. less than the low cost shop operator earns; it will discover that the tool is the same in both cases, hence "conditions" cannot be offered as the scape goat. It will discover a difference of nearly 250 per cent. in piece work prices resulting in a difference of only 25 per cent. in the earnings of the operators; it will discover piece work schedules by which the men earn less, in some instances, than they do on day-work, and it will discover instances where roads with a comparatively large cost for repairs per locomotive per year, show a comparatively low number of miles run per locomotive per year; and with no excuse for this showing in the way of grades and curves at that.

Railroaders, at least some of them, claim that they do not need outside help to cure these "conditions"; and herein it seems to the writer that the old saw is overlooked which runs something to the effect that an outsider is more apt to see things than the insider. The very fact that such conditions exist, and have existed, indicates the unlikelihood of their being curable by the insiders; their idea may be based on the homeopathic idea that "like cures like." It may be correct as applied to repair shops, but that people who designed the piece work schedules and these short sighted policies of repairing locomotives, and who have "stood" for these conditions are capable of reforming themselves is beyond the faith of the ordinary man, guided only by reason and experience.

To sit still under this state of affairs; or, to sponge the outer fringes of the running sore, which it discloses, with an antiseptic solution in the shape of a committee to investigate, etc., is simply one way of looting a road.

The Danish railway minister has asked parliament to increase the rates on both passenger and freight traffic, aiming to increase net earnings by about $1,100,000.

SETTING OUTSIDE ADMISSION VALVES WITH WALSCHAERT GEAR.*

A design of Walschaert valve gear used with outside admission slide valves is shown in Fig. 1. The names of the various parts of the gear are as follows: *A*, valve; *B*, valve stem; *C*, combining lever; *D*, crosshead link; *E*, radius rod; *F*, reverse shaft; *G*, lifting link; *H*, reach rod; *K*, reverse lever; *L*, reverse link; *M*, eccentric rod; *N*, eccentric crank. The main pin is shown on the forward dead center, and the reverse lever is in its middle position, with the link block in the center of the link. A careful study shows that with a valve having outside admission the valve rod is connected to the combining lever at a point above the latter's connection to the radius rod. If the block is in the lower half of the link when in forward gear, the eccentric crank leads the main pin. If the block is in the upper half of the link when in forward gear, the eccentric crank follows the main pin.

Inasmuch as the position of the valve, when the piston is at the end of its stroke, is dependent on the combining lever only, it is evident that the lead given by the Walschaert gear is the same for all points of cut-off. This is the principal feature which distinguishes it from the Stephenson motion as far as steam distribution is concerned. All parts of the Walschaert motion should be correctly laid out and constructed from a diagram, and the gear designed to give the lead most desirable for the usual running speed. The parts having been correctly made, it is impossible to alter the lead without seriously deranging the motion. In this respect the Walschaert gear is less flexible than the Stephenson; but when the correct steam distribution is obtained it is less liable to derangement, and the engine is more easily kept "square."

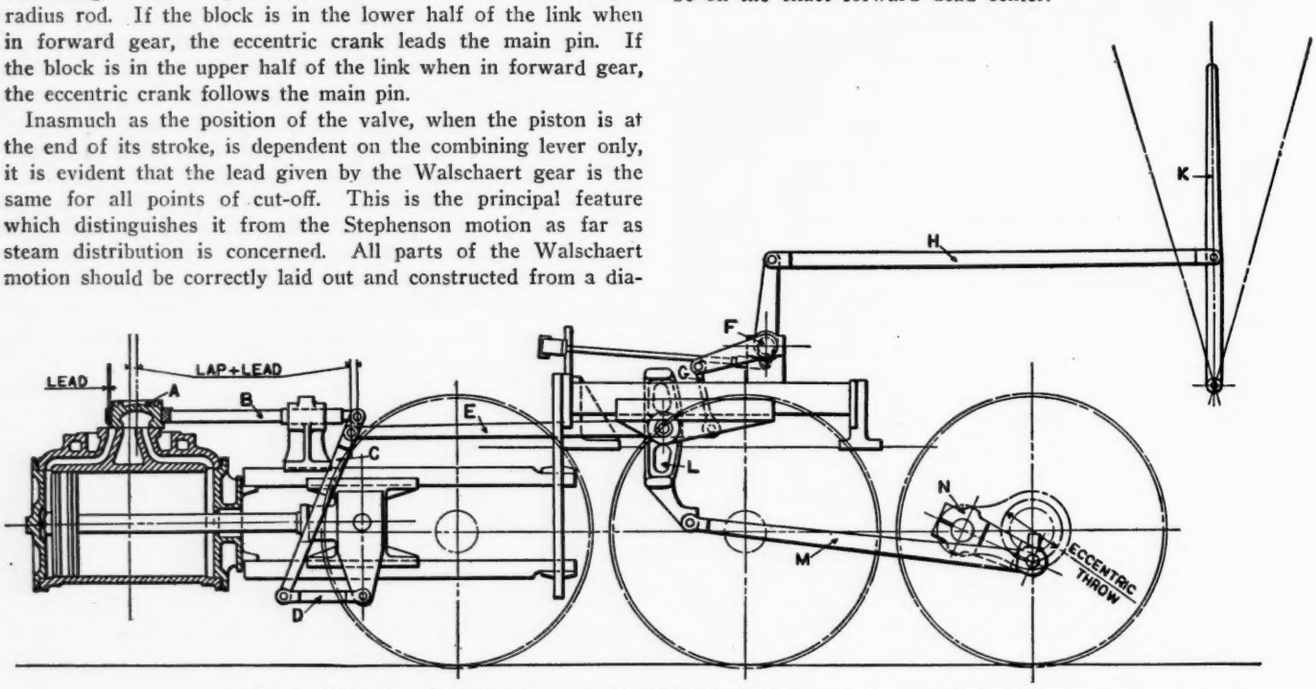


Fig. 1—Walschaert Valve Gear as Used With Outside Admission Slide Valves.

Assuming that all the detail parts have been checked with their respective drawings and that the main rod is up and the gear fully connected, the procedure of setting the valves is as follows:

1. Block the main driving boxes, allowing ½ in. over the central position for settling; viz.: add ½ in. to the dimension between the top of the frame and the center line of the driving journal, as given on the erecting diagram.

2. Obtain exact dead centers. Place the main crank approximately 6 in. or 8 in. below the forward dead center. Put a prick punch mark on any convenient place on the crosshead gib (Fig. 2) and scribe with a tram or a pair of dividers the line *A-A* on the guide. Then prick punch the point *A'* at any convenient place on the line *A-A*.

Next prick punch the engine frame at any convenient place ahead of the driving wheel (Fig. 3), and with a long tram scribe the line *B-B* on the tire. Prick punch the point *B'* at a definite position (say one inch from edge of tire) on this line. Now revolve the wheel backward until the main crank comes above the forward dead center, stopping it when the tram used in Fig. 2 reaches exactly from the point *O* on the crosshead to the point *A'* on the guide. Then re-tram the frame to the tire as in Fig. 4, using the same tram and the same point *P* as in Fig. 3. Scribe the line *C-C* and punch the point *C'* at exactly the same distance from the edge of the tire as previously used in locating B'. This operation will place the point B' (previously obtained) at a distance *Q* from point *C'*. Now prick punch the point *D* at a position exactly central between *C'* and *B'* and at the same distance from the edge of the tire that was used in their location (one inch was previously suggested). Now if the wheel be revolved forward until the long tram reaches exactly from point *P* to point *D*, the main crank will be on the exact forward dead center.

Proceed in like manner to obtain the exact backward dead center, reversing the operation and using the same points on the crosshead and frame, and a new point (forward of the crosshead) on the guide. The standard method used by the Baldwin Locomotive Works for marking these centers is shown on Fig. 5. The trial points are indicated by a single punch mark only, while the final points are indicated by three punch marks, the outermost ones (*D-D'*) being the actual tram points.

The points *S* and *S'*, as shown on Fig. 5, are indicated in a similar manner; the outermost punch marks representing the actual tram points used for marking the half stroke positions.

To obtain the points *S* and *S'*, set the crosshead on the forward dead center and measure back on the guides one half the piston stroke, as shown on Fig. 6. Then revolve the wheel forward until the crosshead moves from position *X* to position *Y*. Now with the long tram obtain point *S* by tramming from point *P* on the frame (Figs. 3 and 4), prick-punching point *S* at the same distance from the edge of the tire as point *D*.

The opposite half stroke point *S'* may be obtained by the same method, preferably revolving the wheel in the same direction (arrow on Fig. 5) so that the influence of lost motion in the parts may be minimized.

The four important points on the stroke are now definitely established on the wheel, and are ready to be used for valve setting. If desired, any other positions of the stroke can be marked on the wheel by using the long tram and the method of procedure described above.

With the ports exposed, place the valve with its steam edge

*From Record No. 70, published by the Baldwin Locomotive Works, Philadelphia, Pa., and entitled "Walschaerts Valve Gear."

cutting off the ports (at each end successively), and prick punch the valve stem at points F and F', obtained by tramming from any convenient place on the valve seat or shelf (Figs. 7 and 8). The distance between points F and F' will be equal to twice the lap of the valve. When the valve is leading (main crank on either dead center) the port should be open by an amount equal to the desired lead (Fig. 9). If the tram is used with the valve on its lead, then the distance between the point so found and the point F on the valve stem will be equal to the lead. (See dimension V on Fig. 9.)

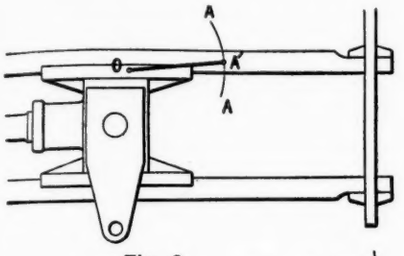


Fig. 2.

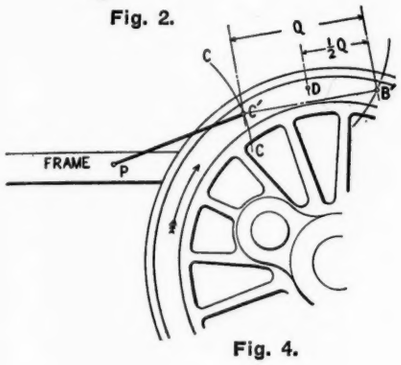


Fig. 4.

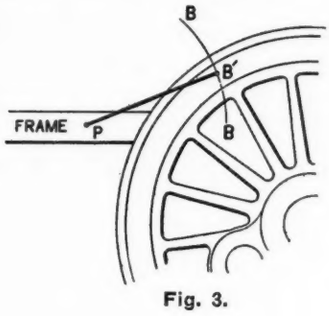


Fig. 3.

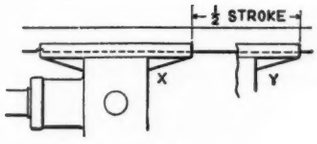


Fig. 6.

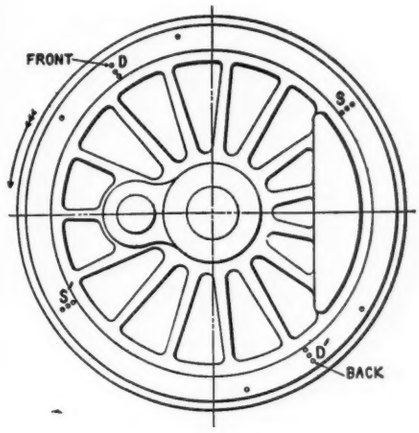


Fig. 5.

With this statement in mind, proceed as follows: Hook up the gear so that the link block is exactly central with the link. Place the train on the forward dead center, and tram to the valve stem. Revolve the wheel to the backward center, and again tram to the valve stem. Measure the distance between the points so obtained, and compare them with the specification. The distance should be equal to twice the sum of the lap and lead. Variation from the specified figures means that an error exists in the combining lever, the upper and lower arms of which are made respectively proportional in length to twice the lap and lead and to the stroke of the piston. (See Fig. 10).

Assuming that the distance L, as trammed on the valve stem, is found correct, the procedure is as follows: Place the gear in forward motion, with the link block at a point in the link that will give the specified maximum valve travel when the wheels are revolved in a forward direction (this position of the link block is obtained by experiment).

Place the main crank on the forward dead center, by tramming from P to D; and with the same tram as used for marking the valve stem (Figs. 7 and 8) scribe on the stem, measuring the distance between the point so obtained and the punch mark F. This distance should be exactly equal to the specified lead.

Revolve the wheel in a forward direction until the main crank is on the back dead center (tram from P to D'), and similarly scribe on the valve stem, measuring the distance between the points so obtained and the punch mark F'. This distance should be exactly equal to the specified lead.

Place the gear in backward motion and examine for lead at the front and back exactly as previously described, except that the wheel must be revolved in a backward direction. If all the points so found are exactly to specification, the valve setting is square. A check should now be made by placing the piston on the forward dead center, and moving the link block through its entire travel in the link. This should in no way disturb the position of the valve.

With the gear set for full stroke forward and full stroke backward, the maximum valve travel should be examined with the piston at half stroke; placing the wheel with the long tram between the points P and S and P and S' respectively (Fig. 5). The travel so measured will not be exactly square at the front and back, as the points S and S' represent half stroke measured from the piston travel, and do not take into consideration the angularity of the main rod.

Travel Irregularities.—The Walschaert gear has inherent peculiarities that frequently cause slight irregularities in the travel of the valve. If, in full gear, this irregularity does not amount to more than ¼ in. out of square between the front and back positions of the valve, it may be ignored, and the squaring of the travel may be considered as nearly perfect as the design will allow. In special cases it may be desirable to square the valve travel when the gear is hooked up to give the cut-off at which the engine is most frequently worked. Thus, on a passenger locomotive, the most satisfactory results may be secured when the travel is squared at one-third or one-half stroke cut-off. In such a case, a slight irregularity at full stroke will probably be unavoidable, but will not prove detrimental. In any event, the particular circumstances under which the engine is to work must determine at what point of cut-off the valve travel shall be squared.

In marking the forward and backward gear positions on the

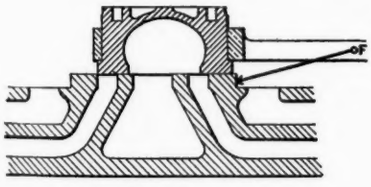


Fig. 7.

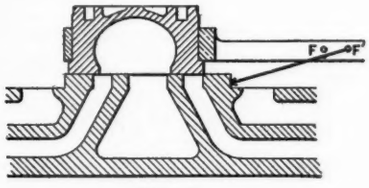


Fig. 8.

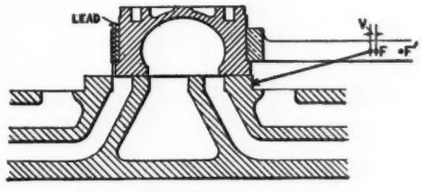


Fig. 9.

reverse quadrant of a "cold engine" an allowance must be made on each end toward the front of the quadrant to correct for expansion when the engine is under steam. The amount of such allowance is a matter of judgment, but ¼ in. to ⅜ in. can be considered sufficient for ordinary standard gage engines.

CORRECTIONS.

If, on trial, the valve gear is found to be out of square on the lead points, the following hypothetical cases will serve to explain the corrections that should be made. For example, suppose the specification calls for the following:

Maximum valve travel, 5½ in.
Eccentric crank throw, 11 in.
Constant lead, ¼ in.
Outside lap of valve, 1 in.
Link block below link center in forward gear.

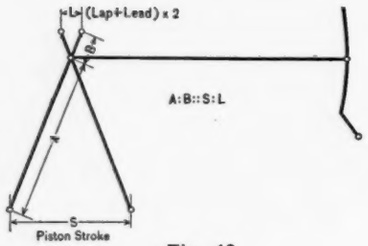


Fig. 10.

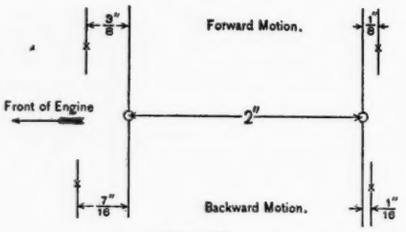


Fig. 12.

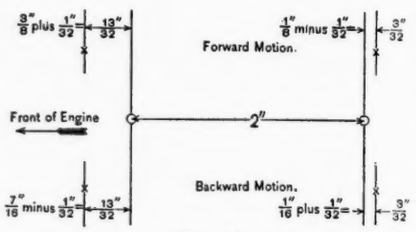


Fig. 13.

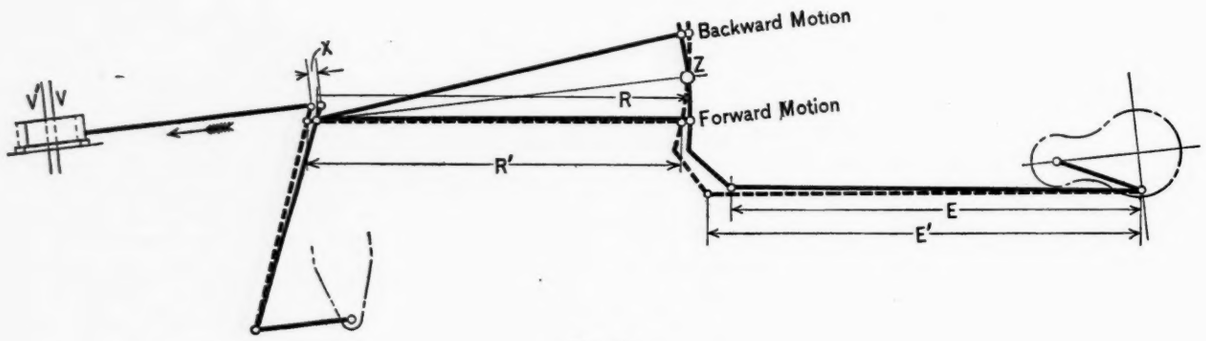


Fig. 11.

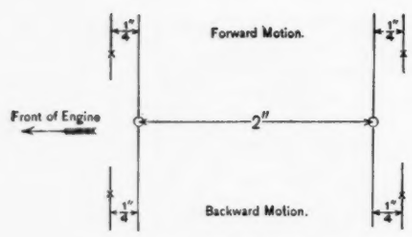


Fig. 14.

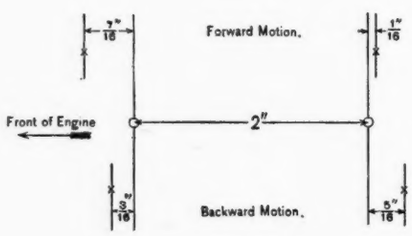


Fig. 15.

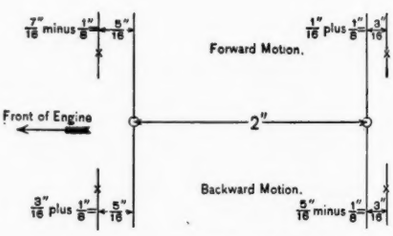


Fig. 16.

It is very important that the following dimensions check exactly with the drawings:

Length of combining lever between central fulcrum and upper and lower arm centers (Fig. 10, dimensions *B* and *A*).

Eccentric crank throw and length of crank arm. In the case under consideration the prick punch marks on the valve stem (Figs. 7 and 8) will be 2 in. from center to center (this is twice the valve lap).

A change in the length of the eccentric rod results in a change in the position of the valve, approximately in proportion to the eccentric throw and valve travel. In the present case, this is as eleven to five and one-half, or as two to one. In other words, a change of ¼ in. in the length of the eccentric rod will move the valve approximately ⅛ in. when the link block is in full gear and the main crank is on the dead center.

The influence of eccentric rod changes on the direction (ahead or back) of the movement of the valve is explained by reference to Fig. 11. An examination of this diagram will show that if the eccentric rod *E* is lengthened to *E'*, then the radius rod *R* will be moved ahead to the position *R'*, and the valve stem will be moved a distance *X* in the direction of the arrow, thus displacing the valve from position *V* to position *V'*.

The following rules can thus be formulated: If the link block is below the link center when running ahead, then *in forward motion* if the eccentric rod is lengthened, the valve is moved ahead. If the eccentric rod is shortened, the valve is moved back.

In backward motion if the eccentric rod is lengthened, the valve is moved back. If the eccentric rod is shortened, the valve is moved ahead.

If the link block is above the center when running ahead, then, in each case, the valve will be moved in the direction opposite to that stated above.

Corrections made to the link radius rod will have approximately full influence on the movement of the valve; viz.: any variation in the radius rod will produce approximately the same variation in the movement of the valve.

The link fulcrum *Z* (Fig. 11) is a fixed point; therefore the direction of movement due to changes in the radius rod will vary directly with such changes, and the following rules can be formulated: *In either forward motion or backward motion,* to move the valve ahead, lengthen the radius rod the amount desired. To move the valve back, shorten the radius rod the amount desired. This is true whether the link block is above or below the link center in forward gear.

With these facts in mind, two hypothetical cases will be considered.

HYPOTHETICAL CASE NO. 1.

Let it be assumed that on tramming to the valve stem with the main crank on the dead centers, the following irregularities in the lead are noticed for the engine under consideration. The dots on the diagrams represent the prick punch marks F and F' (Fig. 8) on the valve stem, while the crosses represent the irregularities in the lead when trammed to the valve stem (Fig. 12). The first procedure will be to divide the error between the forward and backward motions, as follows:

Error in forward motion—

Front, 3/8 in. — 1/4 in. lead = 1/8 in. error.
Back, 1/4 in. lead — 1/8 in. = 1/8 in. error.

} To square the lead the valve must be moved 1/8 in. ahead.

Error in backward motion—

Front, 7/16 in. — 1/4 in. lead = 3/16 in. error.
Back, 1/4 in. lead — 1/16 in. = 3/16 in. error.

} To square the lead the valve must be moved 3/16 in. ahead.

As the errors in the two motions occur in the same direction, it follows that the greater one partially neutralizes the effect of the lesser, and that the combined or average error will be the difference between the two; viz.: 3/16 in. minus 1/4 in. equals 1/16 in. average error.

To divide an average error of 1/16 in. equally about a central point, it will be necessary to move the valve one-half this amount, or 1/32 in. (in this case 1/32 in. back in forward motion). The eccentric rod must be shortened 1/16 in. (in the proportion of two to one) to move the valve 1/32 in. When this has been done the valve stem points will tram as shown in Fig. 13.

The errors in forward and backward motion have thus been equalized, and it remains only to square the lead, front and back, for both motions. The valve as now standing is 5/32 in. too far back to equalize the lead, viz.:

13/32 in. — 1/4 in. lead = 5/32 in. error front.
1/4 in. lead — 3/32 in. = 5/32 in. error back.

As the influene of the radius rod is direct, it follows that by lengthening this rod the amount required (5/32 in.) the valve will be squared, and can be trammed to the dimensions shown in Fig. 14. These dimensions are the ones required by the specification. The valve has thus been squared and the errors corrected by the following changes: Eccentric rod shortened 1/16 in. Link radius rod lengthened 5/32 in. A final trial of the valve and cut-off, etc., can now be made in the previously described manner.

HYPOTHETICAL CASE NO. 2.

Let it be assumed that on tramming for lead, results are obtained as represented by Fig. 15. Divide the error between the forward and backward motions, as follows:

Error in forward motion—

Front, 7/16 in. — 1/4 in. lead = 3/16 in. error.
Back, 1/4 in. lead — 1/16 in. = 3/16 in. error.

} To square the lead the valve must be moved 3/16 in. ahead.

Error in backward motion—

Front, 1/4 in. lead — 3/16 in. = 1/16 in. error.
Back, 5/16 in. — 1/4 in. lead = 1/16 in. error.

} To square the lead the valve must be moved 1/16 in. back.

As the errors in the two motions occur in opposite directions, it follows that they augment each other, and that the combined or average error will be the sum of the two, viz.: 3/16 in. plus 1/16 in. equals 1/4 in. average error. To divide this error equally about a central point, it will be necessary to move the valve one-half the amount, or 1/8 in. (in this case 1/8 in. ahead in forward motion). The eccentric rod must be lengthened 1/4 in. (in the proportion of two to one) to move the valve 1/8 in. When this has been done, the valve stem will tram as shown in Fig. 16.

The errors in forward and backward motion have thus been equalized, and it remains only to square the lead front and back for both motions. The valve as now standing is 1/16 in. too far back to equalize the lead, viz.:

5/16 in. — 1/4 in. lead = 1/16 in. error, front.
1/4 in. lead — 3/16 in. = 1/16 in. error, back.

To move the valve ahead 1/16 in. the link radius rod must be lengthened 1/16 in. and the lead will then be squared. When trammed for lead, the results will be as shown by Fig. 14. These dimensions are the ones required by the specification.

The lead has been squared and the errors have been corrected by the following changes: Eccentric rod lengthened 1/4 in. Link radius rod lengthened 1/16 in.

Trial of the valve travel and cut-off, etc., can now be made in the manner previously described. From the above it is evident, that the errors in forward and backward motion are equalized by changing the length of the eccentric rod; and the lead is then squared by changing the length of the radius rod. Theoretically the radius rod should not be changed; but the amount necessary is so slight, that it makes practically no difference in the movement of the valve.

With outside admission piston valves the arrangement of the gear is the same as that used with outside admission slide valves, and the method of setting is the same. The line and line positions of the valve, however, must be observed through peep holes, as in the case of the inside admission piston valve.

THE Y. M. C. A. PLAN OF INSTRUCTION FOR APPRENTICES AND SHOP EMPLOYEES.*

BY F. M. M. RICHARDSON.

Educational Secretary, Railroad Department, International Committee of Young Men's Christian Associations.

In September, 1906, the Young Men's Christian Association undertook to conduct the apprenticeship school of the Westinghouse Air Brake Company at Wilmerding, Pa., on company time. Conducting apprenticeship schools for corporations was not a new experience to the Young Men's Christian Association, but it was new to conduct one during the working hours. It meant that the apprentice received the same rate of pay for attending classes as for some productive work in the shop, and that he received special instruction better fitting him for the trade in which he was indentured. In the last five years considerable progress has been made in the development of such schools and the day plan has been successfully adopted by a number of industrial and railway corporations.

The first class of railway shop apprentices under the Association plan was opened in November, 1909, at the Pine Bluff shops of the St. Louis Southwestern. This was closely followed by the opening of classes on the Delaware, Lackawanna & Western at Scranton in January, 1910, and later with classes at East Buffalo and Kingsland, thus placing all the apprentices of that road under instruction. On the St. Louis Southwestern the work begun at Pine Bluff was extended to Tyler, Texas, at the end of the first year, thus including all apprentices on that system.

The plan of operation is based on the idea of uniform instruction over the lines of any railway system and is a part of the system educational work of the railway department of the International Committee of Young Men's Christian Associations. Where a Railway Association is located at a shop point the work is done in co-operation with that Association. The absence of such an Association does not, however, prevent the establishment of a school at any point, as the instruction is generally conducted in a room provided by the company on the shop grounds.

In considering a modern plan for the instruction of apprentices the first two questions to be met are those of cost and allowing time out of shop. The latter question is involved in the cost but its significance is in its relation to the working conditions prevailing in the shop, and it is summed up in the query, "To what extent would the output of the shop he affected by releasing the apprentice for a number of hours' instruction each week?" The question can best be answered by those who have tried the day plan of instruction and have found that the increased efficiency of the apprentice due to instruction more than offsets the loss of the several hours spent in the class room each week. There is still a tendency on the part of some to believe that while this may be true of the shop with a large number of apprentices, it cannot apply to the shop where but a few are employed and where the work of each apprentice counts as a definite part of the shop output. However, with a flexible plan like that of the Association the local conditions may be met so as to give to the shop a practicable working scheme for the instruction of the apprentices employed.

In one of the shops where the Association plan is in operation there are but fourteen apprentices, divided among four trades. Each apprentice attends one class session in one three-hour period, but the apprentices are divided into two classes, so that by this arrangement not more than half the apprentices in each department are out of shop at any one time. In another shop the group is divided into four classes, and thus only one-fourth of the apprentices in each department are out of the shop for one period of instruction once each week. An arrangement of this kind brings together the apprentices of the different trades for instruction in the same class period, but the class is small, making a splendid condition for individual instruction, which is the key to effective results. The instructor is thus permitted to meet

*Entered in the competition on the instruction of workmen and apprentices which closed April 15, 1911.

individual needs and to adapt the instruction to a constantly changing class, as new boys are enrolled to take the place of those just out of their time. While the classes referred to above are operated on the three hour class period the Association recommends four hours weekly in class groups not to exceed fifteen apprentices each, where the local conditions permit such an arrangement.

In determining the cost of any system of apprenticeship instruction three elements are to be considered, viz., the operating expense of the educational scheme, the wages paid for time spent under instruction, and the loss represented by what profit might have been derived from the product of the labor of the apprentices if employed productively in the shop for the same period as that spent in the classroom. Of these three elements the last is frequently regarded as negligible, while the real cost is figured on actual output represented in the items of operation and wages. The extent of the wage item in the estimated cost depends on the total number of apprentices employed, on the rate paid, and on the number of hours given for class instruction. This is a fixed cost so that any economy effected must come under the operating expense of the system of instruction measured by its effectiveness as a producer of results in the shop.

Few shops have apprentices enough to require the entire time of one instructor in the classroom where the apprentices are given but four hours instruction weekly. The average shop on this basis requires but part of one instructor's time each week, and the remainder of the week must be spent in some other phase of work or in instruction at other shops on the system. The Association has adopted the latter plan which permits the economic arrangement of using the traveling instructor, who gives his whole time to instruction and to matters relating to the apprentice school. On the Delaware, Lackawanna & Western with over two hundred apprentices at three shop points two instructors are able to handle all the classroom instruction. On another system for which plans have been drawn up to give instruction to the four hundred and fifty apprentices divided among twelve shop points, five instructors will be able to conduct the work of the classroom. Train schedules determine in part the number of instructors necessary to give the required instruction under a given set of conditions. On the small road and on systems having but a few shops the whole time of one man can be profitably used in giving instruction, because of the desirability of making the classes smaller and of combining the duties of shop instructor with the regular classroom duties. Every shop should have one man acting as shop instructor for all or part of his time, depending on the number of apprentices employed. The shop instructor's chief value lies in his ability to direct the effort of the apprentice in the application of the classroom instruction to shop practice, to give the necessary instruction on new operations and to detect lost motion on the part of the apprentice.

The problem of the small independent shop with apprentices enough for one small class requiring not over five hours of the time of an instructor each week is adequately provided for in the Association plan. Plans for such a shop have recently been submitted whereby an instructor will be furnished one morning weekly, and his work will be supervised by the educational secretary of the local Railway Y. M. C. A. Association for the actual cost of conducting the instruction.

Under the Association plan one organization comprehends the whole scheme of instruction, and thus each road adopting the plan is relieved of organizing a department to carry on the instruction. This removes the overhead charge of a department, and yet insures the necessary supervision, instructors, and instruction sheets prepared by experts employed by the Association. These instruction sheets conform to standards prevailing on the road where the instruction is to be given.

What a master mechanic thinks of apprenticeship under Association auspices is suggested in the following statement: "I am well pleased with the showing, and you cannot realize, unless you are placed in daily contact with the men you are teaching, the foundation you are laying for these young men. You are not only doing great good in preparing a path which will be much easier for them to travel, but you are benefiting the shop immensely." This statement, made in a letter acknowledging the receipt of a monthly report, comprehends the two fundamental principles underlying the Association plan of instruction, viz., moral value and practical results. Any test less than this would be unfair to both the company and to the Association, for the apprentice of today is the mechanic of tomorrow and on his development depends the efficiency and the moral tone of the mechanic of the future.

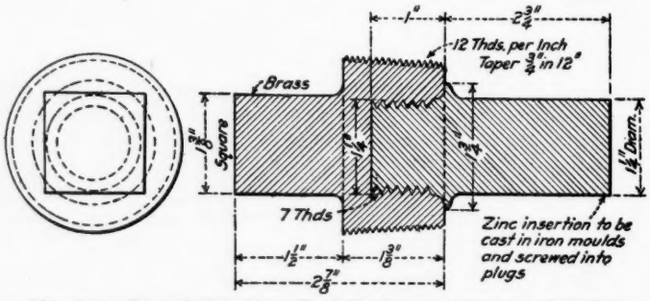
What the apprentices think of modern apprenticeship is suggested by the following quotations: "The school is the best thing the Delaware, Lackawanna & Western ever gave us." "It helps us in our work. We need lots of drawing, for we get lots of it on patterns." Another says "I am satisfied because there is great improvement in my arithmetic," while another replies, "I don't think we have any kick coming, as we are doing nicely."

The establishment of an apprentice school has a stimulating effect on other shop employees. In connection with one of the first schools to be opened an evening class was organized for journeymen, and the first man to enroll was a shop foreman. At another point an evening class for journeymen was organized at their request and the class filled up to its seating capacity. Where the apprentice instructor is not crowded in his day work this evening work may be handled by him, as is the case on the St. Louis Southwestern.

While these side lights indicate the educational influence produced by an apprenticeship class, the main issue on which an appropriation to conduct such schools must be justified, is the apprentice himself and his training and consequent increased efficiency. Naturally the offering of educational advantages to the apprentice permits the company to require that he be qualified by his previous schooling to take advantage of what is offered educationally. Incapacity and indifference likewise may operate as a means of elimination of unpromising material, and thus the school becomes a means of developing carefully selected men to supply the needs of the future for leading workmen in railway shops.

ZINC END ON WASHOUT PLUG.

Zinc is said to be particularly effective in preventing corrosion due to electrolysis, as it is electro-positive to iron and will protect iron or steel at its own expense as long as it is kept in contact with it. In accordance with this theory, the Chicago & North Western is using a zinc insertion on the inner end of brass washout plugs. The plug thus made is here illustrated.



Washout Plug With Zinc End Projecting Inside of Boiler.

The zinc is cast in iron molds and is screwed into the washout plug. The projecting end of zinc is 1¼ in. in diameter and 2¾ in. long. It is found that most of the zinc is eaten out in less than two weeks, and to that extent it has prevented corrosion and pitting by electrolytic action. We are promised the further results of this experiment, which aims to prevent the corrosion and pitting of locomotive boiler sheets and tubes.

ENGINE HOUSE KINKS; PENNSYLVANIA RAILROAD.

BY ROBERT G. BENNETT,
Motive Power Inspector, South Pittsburgh, Pa.

TIRE HEATING APPARATUS.

A portable fuel oil tire heating apparatus, designed for use at outlying engine houses and on the road, is shown in Fig. 1. If an engine failure occurs on the road, due to a loose tire, the tire heating apparatus is placed on a locomotive at the nearest engine terminal and is hurried to the spot at once. This is a great improvement over having the engine give up its train and go to the terminal light, while another engine is despatched to bring the train in. A workman familiar with the operation of the tire heater accompanies it, and with the aid of the crew places the apparatus on the ground near the tire that is to be heated. Compressed air is available by making a connection with the train line on the engine. A ring of 1-in. wrought iron pipe having 1/16-in. holes spaced 3 in. center to center on the inner side, is placed over the tire. A set of these rings of various diameters is kept on hand for the different size tires. The four small pins on the inner side of the ring, ½ in. long and ½ in. in diameter, keep the ring the proper distance from the tire.

The heater consists of an oil tank *A*, 18 in. in diameter. Compressed air for forcing the oil from the tank to the burner, and also for mixture with the oil to provide proper combustion, is supplied from the shop air line or from the train line, if on the road, through the connection *B*. When the heater is used on the road during very cold weather, steam from the steam heat line on the locomotive is connected with the pipe *C*. The steam passes through this pipe, heating the oil, and is exhausted to the atmosphere. The tank is refilled with oil through the connection at *D*. The use of the cock at *D* makes it possible to reduce the air pressure in the tank slowly when it is opened for refilling. The apparatus has two burners for use in the engine house; only one is necessary when it is used on the road. Each burner is connected to the tank by two 8 ft. lengths of ½ in. air hose, one for the oil and one for the air.

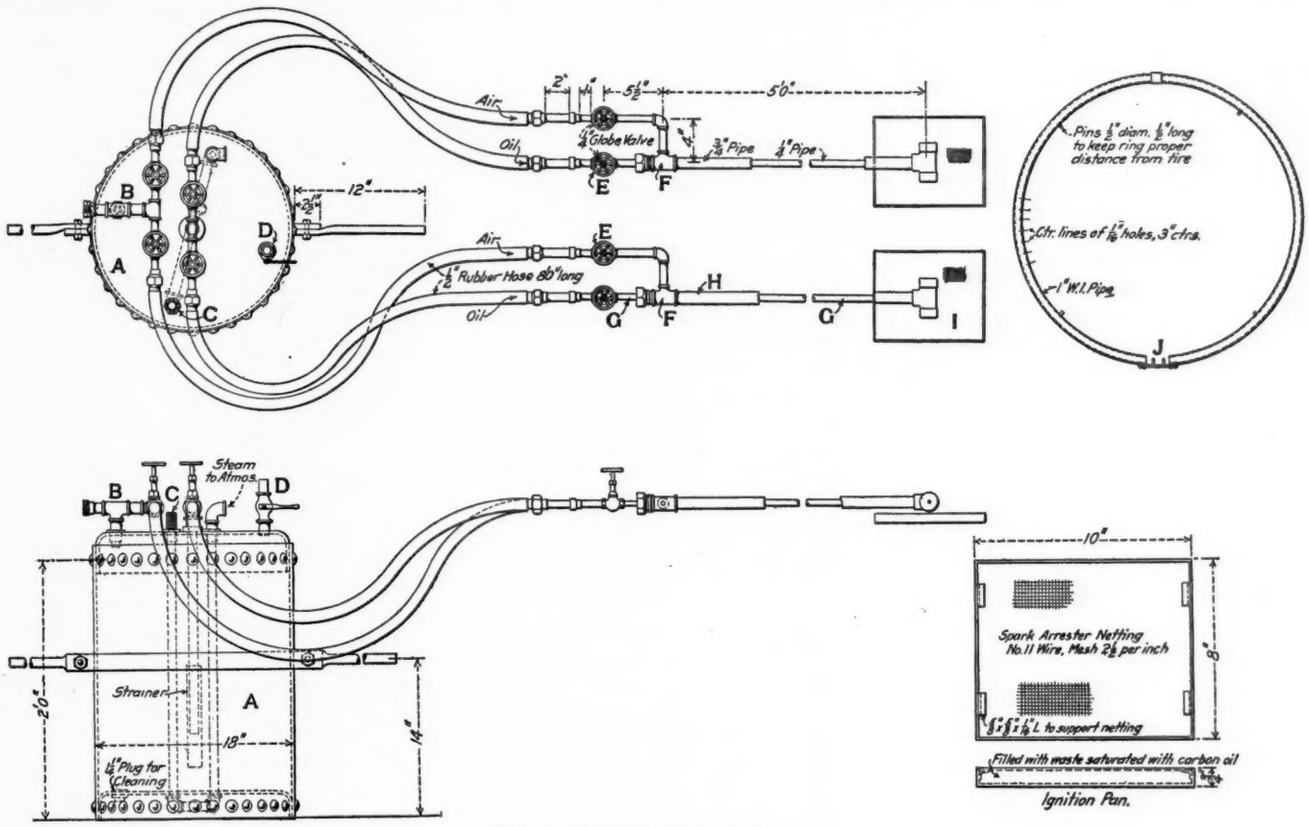


Fig. 1—Tire Heating Apparatus.

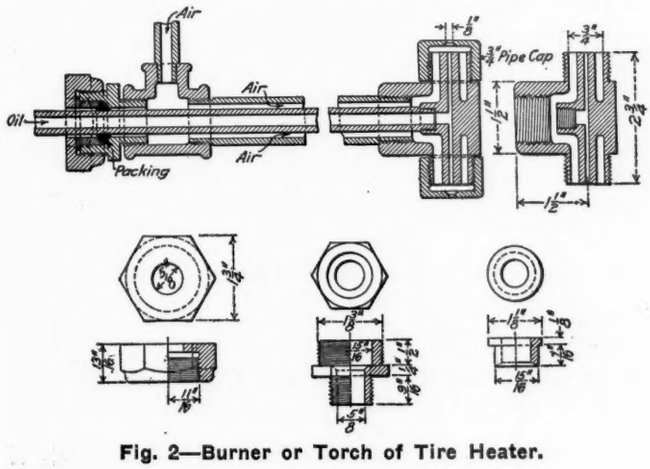


Fig. 2—Burner or Torch of Tire Heater.

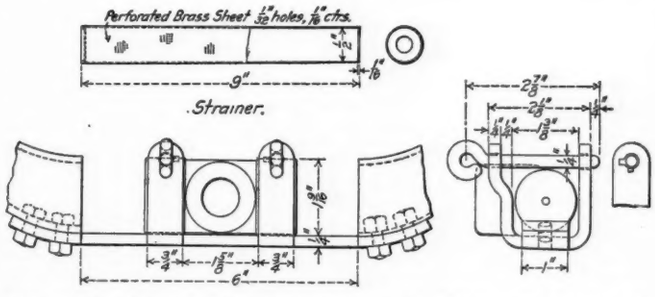


Fig. 3—Method of Clamping Burner to Ring and Detail of Strainer in Oil Tank.

The flow of the air and oil through these pipes is controlled by the ¼-in. globe valves *E*. The air after passing through the valve enters the ¾-in. wrought iron pipe *H* through the ¾-in. x 1¼-in. tee, *F*. The oil passes through a ¼-in. pipe, which extends inside of the ¾-in. pipe, as shown by the detail view of the burner, Fig. 2.

In lighting the burner, a piece of oily waste is burned on the pan *I*, igniting the oil as it leaves the burner. The burner is

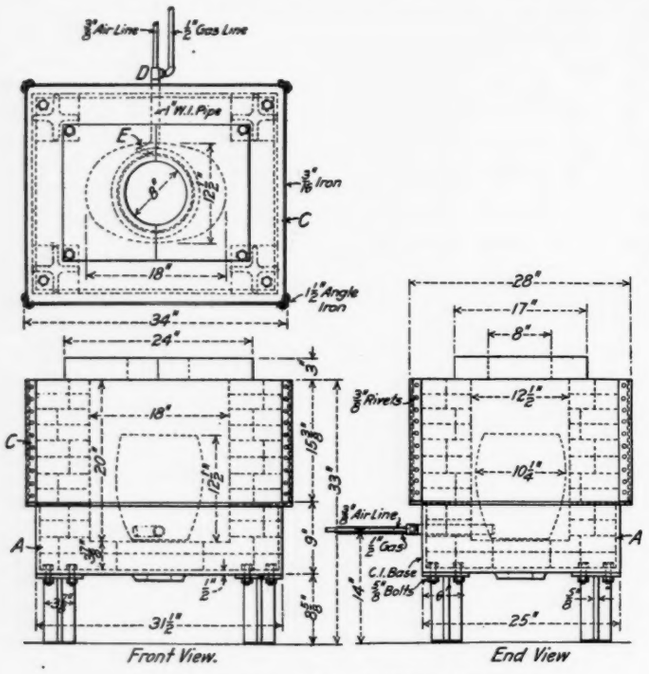


Fig. 4—Furnace for Melting Bronze.

clamped in the heater ring at *J*, as shown on the detail drawing, Fig. 3, and the flame from its two ends is forced into the 1-in. pipe and out through the 1/16 in. holes. Fig. 3 also shows a detail of the strainer that is placed in the oil tank, which consists of a perforated brass sheet with 1/32-in. holes spaced 1/16 in. center to center. A detail view of the ignition pan is shown on Fig. 1. Approximately 2½ gal. of oil are used per tire. It is mixed in the proportion of 3 gal. of fuel oil to 1 gal. of

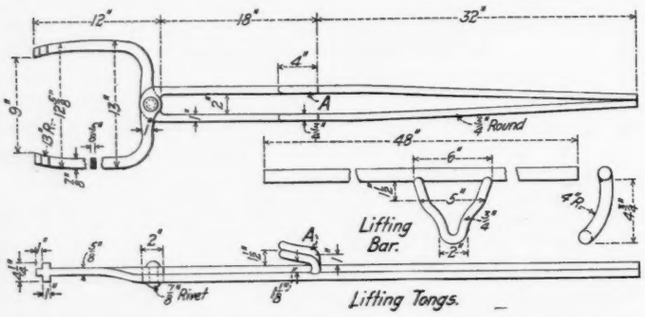


Fig. 5—Tongs and Lifting Bar for Removing Crucible from Brass Furnace.

carbon oil. About eight minutes are required to put on a tire with this apparatus.

SMALL FURNACE FOR MELTING BRONZE.

On many of the large locomotives which use the Stephenson valve motion, it is necessary for the valve rod to extend back through the guide yoke, and at this point a valve rod yoke bearing is placed through which the bronzed end of the valve rod travels. As is usual with such parts this bearing wears, and it is necessary to renew it often, consequently the use of the bronzed sleeve on the end of the rod. It is often of considerable advantage to be able to bronze the valve stem quickly at an engine house, in order that the engine may not be held out of service waiting for material or by having this work done at a larger shop. A small furnace for melting bronze for this class of work is shown in Fig. 4. It consists of a cast iron base *A*, measuring 24 in. x 30½ in. inside. This is mounted on four short legs, which are 8⅝ in. high. The inside of the base is lined with fire brick and asbestos. Above the base a heavy sheet iron casing *C* encloses the fire brick walls, holding them in position, and also assisting to retain the heat in the furnace. The opening for the crucible is elliptical and of the proper size

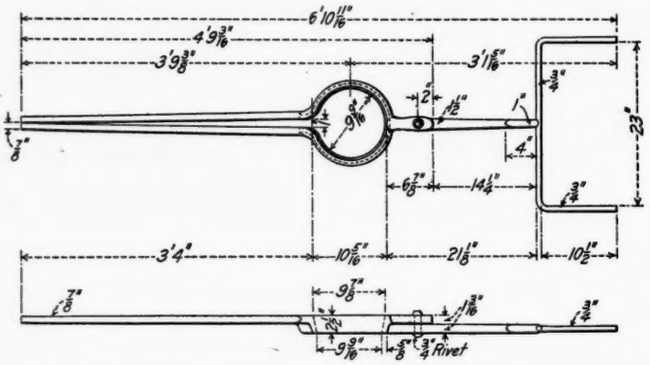


Fig. 6—Tongs for Pouring Bronze from Crucible.

to hold a No. 35 McCullough-Dalzell crucible and to allow sufficient room for the tongs, which are shown in Fig. 5, to grasp it. A ½-in. gas line and a ⅜-in. air line tap into a 1-in. wrought iron pipe line at *D*. This 1-in. pipe is curved at *E*, so that the flame will encircle the crucible. A cast iron cover or loose fire brick is placed over the top of the furnace while the contents of the crucible are melting. The lifting bar is designed to catch the tongs at *A* and to hold them fast to the crucible while the workmen lift it from the furnace. The contents of the crucible are poured by means of the tongs shown in Fig. 6. Prepared or iron molds may be used, either of which should be made in half sections so that they may be easily placed and centered about the piece that is to be bronzed.

STANDARDIZATION OF RAILWAY TINWARE.

The standardization of railway tinware from the viewpoint of the manufacturer was treated in a paper presented before the recent meeting of the Railway Storekeepers' Association by A. H. Handlan, Jr., of the Handlan-Buck Manufacturing Company. He said: "We established standards on railway tinware and introduced them some years ago. These patterns are standard on many of the systems throughout the South and West. However, changes have been made from time to time to suit the particular demands and requirements of the departments using tinware, and we now find ourselves manufacturing from a large variety of special patterns, comprising for instance, 25 or more patterns for an ordinary engineers' torch, any one of which in all probability would really answer any road's requirements. Our pattern room contains a vast assortment of patterns—some that are obsolete, some used perhaps once in a year, others used daily—until our stock of patterns in the pattern room is greater than the stock of finished material in the store room. Please bear in mind, however, that this feature is not a serious objection of, or a burden to the manufacturer.

"Owing to special designs required by the railways, the manufacturer has been compelled to exact from them a contract specifying the approximate quantities of tinware required during a specified time, and an assurance that this amount will be specified for; further, if the railway should subsequently place its contract with another manufacturer, it is obligatory on its part to

take from the hands of the manufacturers any stock that was made up and specially stamped for it, whether one or more of these articles is obsolete or has been discarded as a standard by the railway. This understanding between the manufacturer and the railway is of necessity in order that a sufficient stock of these special patterns can be maintained in order that reasonably prompt shipment may be made. Under these conditions, there is naturally evidence of an unnecessary expense, the burden of which is borne by some one.

"Now comes the time when it seems most essential that the matter of standardization of tinware should be considered, and if possible, standards should be adopted that will serve the requirements of all railways. The manufacturer could furnish material cheaper for the reason that the goods could be turned out at less cost by making them in larger quantities. The metal worker can work faster and to better advantage on regular standard types than on special types; consequently, the manufacturer can arrive at almost the exact cost of the finished product instead of estimating it as is now done.

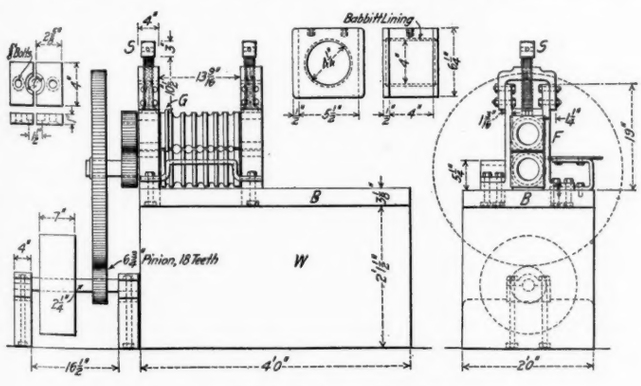
"I believe the railways will benefit greatly by standardization of tinware for the following reasons: The manufacturer would carry the stock. The manufacturer upon receipt of order, could label the standards specified, and ship at once—delays in shipment are expensive. The manufacturer would relieve the railway of the necessity of carrying two or three months' requirements. The manufacturer with the assurance of standards, would purchase raw material in larger quantities and cheaper. The railway could probably purchase at lower cost and standardization would insure uniform material."

REDUCING ROLLS.

BY C. C. LEECH.

Foreman, Pennsylvania Railroad, Buffalo, N. Y.

A machine for reducing the size of iron rods is shown in the accompanying illustration. The rolls are mounted in bearings which are supported by housings bolted to the cast iron bed *B* which rests on a wooden foundation *W*. Power is furnished from an overhead countershaft equipped with tight and loose pulleys and having straight and cross belts in order to reverse the motion of the rolls. The iron beds which are to be reduced are heated in a furnace conveniently located and the rolls are started. The rod is first entered in the largest groove and passes through it. The end which comes through last is seized



A Simple Reducing Rolls.

by an operator with a pair of tongs and the machine is reversed, the rod being started back through the next size smaller groove. This operation is repeated until the rod is reduced to the proper diameter. With this arrangement it is necessary to have an operator on both sides of the rolls, one reversing the machine for the other; provision might be made, however, for an automatic reversing arrangement. The bearings of the bottom roll are stationary, but the upper roll may be raised or lowered by means of the screws *S* that are attached to the top boxes which move in grooves in the supporting frame *F*. The projection *G* on the upper roll, which fits in a corresponding groove in the lower one, keeps the rolls in line with one another.

MASTER BOILER MAKERS' ASSOCIATION.

The fifth annual convention of the International Master Boiler Makers' Association was held at the Rome Hotel in Omaha, Neb., May 23-26, A. N. Lucas, of the Chicago, Milkaukee & St. Paul, presiding. The first day was occupied solely with addresses of welcome and responses thereto. It was on the morning of the second day that the real business was begun in a consideration of the question of apprenticeship.

BOILER MAKER APPRENTICES ON THE NEW YORK CENTRAL LINES.

The subject was opened by C. W. Cross, superintendent of apprentices of the New York Central Lines. He outlined the general methods of work, with which the readers of the *Railway Age Gazette* are already familiar, and emphasized the practice of giving the apprentice boys a good all-around training in the practical part of the work, changing them about frequently so they will have an opportunity for experience in all of it. The boys are worked with experienced mechanics, and in some cases alone, with their program of progress arranged in proper sequence to give them a full knowledge of the practical part of the work. The apprentices are also sent to a school on the shop property two mornings a week during working hours and white under pay. Here they are taught the principles of mechanical drawing and mathematics particularly suited to the work. After the early part of the course the school work is specialized to suit the several trades.

Care has been taken in arranging the course of instruction to avoid any impossible or finely figured standards and to keep in mind the traditions of the business with regard to methods of performing work, confining the instruction to fundamental principles on which all agree. For instance, an attempt would not be made to designate the best arrangement for a hydraulic riveter in a shop, realizing that a discussion of the relative merits of a riveter in a pit as compared with the elevated pattern could be carried on until every one was exhausted without any prospect of reaching a unanimous conclusion. All the work that is introduced is in accordance with the New York Central Lines standard practice, from which illustrations are selected. A system of reports is made by the shop instructors and the school instructors to the local shop officer which are in turn forwarded to the apprenticeship headquarters. Special emphasis is placed on the personal touch maintained between the instructor and the aprentices with a view to ascertaining the type of work or branch of service for which each boy is best fitted. It has been found necessary to use great care in selecting instructors, who must be men who are not only competent, but are willing to undertake the work for the love of it and their interest in the young men, as well as for the remuneration they receive.

A unique feature of this apprenticeship is the individual factor. No attempt is made to group the apprentices in classes, but rather to advance each one as much as possible, taking into consideration the personal characteristics and educational foundation as well as the physical qualifications of the apprentices. An effort is made to teach the student concentration of mind, realizing that many of the boys have not had discipline of that kind. An earnest effort is made to develop in the young man the habit of study.

The impression seems to prevail that the New York Central Lines is educating apprentices for other roads. It is a fact that we lose a large number of apprentices and graduates from the apprentice department; this is in a way a compliment to the apprenticeship system, but we would prefer to hold the boys in our service. It is well known that boilermakers are somewhat

of a nomadic nature, and this tendency to migrate cannot be stopped. A reasonable amount of changing from one shop to another is beneficial to a young man, as it develops his initiative and self reliance and gives him extended oportunties for observation of shop practice from which he can select the best methods of doing work, making him a more valuable employee and in many instances enabling him to secure promotion; however, care should be taken that he does not became a confirmed gypsy. Although the desertions from the service are somewhat of a menace, it is believed that conditions will improve due to the recent awakening of interest in industrial education. Inquiries and observations from all directions indicate that other railways and manufacturing establishments are now giving this subject the consideration it deserves, and in some instances have taken action in inaugurating some parts of the plan.

The fact is being demonstrated that no outside system of instruction, such as trade schools, correspondence schools, or even the Y. M. C. A., can fully meet the needs of apprentices, and that the control and direction of the instruction must be coincident with the control and direction of the shop. Indications point to the day not far distant when each road will have a fully equipped apprenticeship system organized as an integral part of its motive power department. Before such a movement can start the management must be convinced that for its own welfare in the future it must be provided with skilled, intelligent workmen trained in its own shops; men who can stand on their own merits and do the work which is needed; men who will command the respect of their employers, who can and will bring skill and judgment to their work so that they may command compensation commensurate with their increased ability. To supply the need we must train the hands and the minds of our recruits. The present emergency seems to compel us to take the school to the boy for the training of the mind. Our greatest work is in the shop. The boy is in the shop and we must move the school to him for we cannot move him to the school. We cannot wait for the educators to adapt themselves to our problem, but must take it in hand ourselves—hence the apprenticeship department.

It meets the need because the boys who come to us are those who must work every posible working hour in order to make a living. They cannot afford to go to school. Even if they could learn trades in a trade school they cannot afford to do so. It is a most direct and definite educational work. The boys know what they want to do in life and they are doing it. They are learning to use their hands under the direction of skilled teachers of their trades, and the training of the mind naturally associates itself with the training of the hand. Because the boy is making his place among men while acquiring his education and is educated in his work while at work, this type of school surpasses all others in directness, definiteness and in conservation and concentration of the attention of the mind of the boy. To these advantages another of great importance is added. The boy does not finish his school work and then find it necessary to establish himself in a working position. He is already in such a position and is fitting himself daily the better to fill it and prepare for advancement. He is already making friends of his superiors who are beginning to rely on him in the organization. Trade school boys and even technical school graduates do not enjoy this advantage. For these reasons the responsibility of those in charge is great because the possibilities of achievement are limited only by the scope of the plan and by the sincerity and ability with which the work is carried out. It may be narrow or it may be broad. It may be selfish or it may be generous.

In a few years much has been accomplished. It is reasonable to expect that the good results which are promised with certainty to those broad-minded enough to establish these schools and aprenticeships will lead to their multiplication. The movement was carried completely across the continent in two jumps by the New York Central Lines and the Atchison, Topeka & Santa Fe. A number of other roads have also inaugurated definite apprenticeship systems with educational features.

Mr. Cross was followed by his assistant, Henry Gardner, who presented in a very striking manner the methods and results obtained on the New York Central Lines. He showed through the medium of lantern slides, the character of the instruction papers that are used in the classroom work, their extreme simplicity and how they are adapted to the mind of the boy. They showed concrete ideas of fractions; they illustrated, in detail, the various kinds of hammers and chisels that are used; the reasons for using handles on some, and why those handles were put in tight or loose. They showed the way to use a file, and illustrated the kinds of staybolts that are used; the difference between a tube expander and a roller. Then there were illustrations of the various drawing sheets; starting with the simple methods and working up to the more complex, in which the problems of laying out were involved. Pictures of models were also given, which were used, first to give the boy an idea of what he was to make; and then, after he had laid out the sheet and cut it from paper, they served as a base about which to wrap it to see if it fitted.

In this drawing work they do not follow the practice of the schools and the text books of merely laying out the limit lines, but allowances are made for laps and all the thicknesses of sheets. Then, too, the boys are not allowed to use tools in the laying out in the drawing room that would not be available in the shop. The dividers, for example, are used for the determination of the center line of a sheet, and the T square is debarred.

The laying out progresses regularly and systematically until the whole scheme of boiler construction has been covered. And yet the steps from one point to the other have been so gradual, that there has been no cramming or straining on the part of the boys, and the end is reached easily and with certainty. It is an extensive application of kindergarten methods with results that are by no means of the kindergarten kind, as was shown by photographs of the work done by second, third and fourth year apprentices. These showed firebox sheets, wrapper sheets, tube sheets, back heads and domes laid out and ready for use on the locomotive by boys not yet out of their apprenticeship.

BOILER SHOP APPRENTICES ON THE SANTA FE.

F. W. Thomas, supervisor of apprentices of the Santa Fe, said: Boys wishing to learn the boiler maker's trade are numerous in one section and very scarce in another, depending on the class and personnel of the men in the shop. In some few localities we can get all the boys we can use, while in other places—the majority of places—there is a dearth of such applicants. If there is a good, steady body of men, accommodating, obliging, honest and moral in character, the boys will come. On the contrary you will experience the reverse when you have a rough, rowdy class of men, mixed with a large number of the foreigners.

The work in a boiler shop is hard, noisy and disagreeable. Its very noise robs the work of any sociability. While we do not expect the men to hold social levees, yet in all other trades there is a certain amount of visiting while the men are legitimately passing to and fro, in moving from one part of the shop to another in the discharge of their duties. Neither does the present day boiler shop offer much encouragement to the boy. Promotions to higher positions, nine times out of ten go to the machine shop. I do not know of more than one or two cases where the position of master mechanic and other higher positions are filled by boiler makers. The only conclusion to be drawn is that the machinist is better fitted for these jobs. It takes as much brains to make a boiler maker as it does a machinist, a blacksmith or a cabinet maker. In requires if anything a greater honesty. So much of the boiler shop work cannot be inspected as to its workmanship—as to its faithfulness.

I do not think the boiler shop and the boiler maker have kept pace with the machine shop and machinist in advancement, new inventions, education, research and personnel. The impression is prevalent that anyone with muscles and wind can drive

staybolts or rivets; anyone with a day's training can roll flues; anyone with a week's life in the shop can lay up a patch. You have stood by, and by your silence approved the implied assertion that anyone can be a boiler maker who is possessed with brawn and muscle. We must call a halt and come back to the fact that it is just as important to have brains and education in a boiler shop as in any other department of the organization; good men, intelligent men, mechanics, are needed badly in the boiler shop.

The Santa Fe system has 635 apprentices on the system; 629, or all but six, enjoy the benefit of our educational system. Where the shops are not of sufficient size to employ a regular resident instructor we have traveling instructors who spend at least two days a week with these boys. We appreciate the value and importance of shop instructors and we have been most liberal in providing these practical men. The foreman should be relieved of such duties; he has too many other troubles, and when the men are on some contract or merit system, it is not fair to require the foremen to show or help the apprentice. There is no shop where the instructor can be so valuable, no shop where the instruction is so badly needed as the boiler shop. This shop offers too many opportunities to slight work; to hide defects. An instructor devoting his entire time to the boys can eliminate a great deal of this. Where there are fifteen apprentices it will pay any boiler shop to employ a regular shop instructor. He can run the shop in the absence of the foreman. He can make himself invaluable to his employer and to his foreman by keeping his eyes on any particular job. With the help of his instructor the boy can go right along with the work. He is taught the name and the use of any shop tool or machine, the "ins" and "outs," and tricks of the trade early in the game, and need not waste valuable time in endless and expensive experiments. He begins to manufacture and produce the minute he enters the shop.

The school end of the instruction concerns such branches as are needed in his work, robbed of all frills and trimmings, simple in the beginning but gradually leading up as he advances in age to more difficult work, such as the spacing of holes, squaring up sheets, laying out with the least waste of material and time, triangulation, projectatory methods of laying out, ability to make a sketch, and to intelligently interpret a blue print, illuminated display drawings to explain the reason and necessity for lapping metal properly, spacing rivets and stays, importance of laying metal to metal and not depending on caulking. These are the things he needs in his chosen work, things he remembers, things of value.

It has been often said that the establishment of one of the justly famous hotels by Fred Harvey along the line of the Santa Fe improves the moral tone of the entire town. It has been equally evident in the improvement of the moral tone of our shops by the establishment of an apprentice school.

JACOBS-SHUPERT FIREBOX.

As the committee assigned to report on the radical departures that are being made in boilers and fireboxes had no report to make, the subject was turned over to A. W. Whiteford, the mechanical manager of the Jacobs-Shupert Firebox Company, to present the merits of the design which he represents. His talk was illustrated by lantern slides. With these he showed how the firebox was a machine-made structure. The channel units for the inner and outer sheets are received as flat plates, cut to size, from the mills. They are heated and with a single stroke of the press are formed into channels and bent to the shape required for the firebox. As they are all duplicates they are laid out for drilling with a template, it being possible for a second year apprentice to do this work. The same holds for the stay sheets, the back head and the back tube sheet. As for the rivetting, it is all done with an hydraulic rivetter, the only portion of the work that follows present methods being that of connecting the firebox to the shell, which is done by hand or pneumatic rivetting.

The claims of superiority that were made for the box were that it was purely of a machine-made construction, and, therefore, cheap; and that it was far more efficient and economical than the ordinary boiler. In addition to which great stress was laid upon the higher degree of safety that could be obtained with it as compared to the ordinary firebox.

The speaker culled from Prof. Breckenridge's experiments to show the rate at which heat is transmitted from the firebox through the sheet to the water behind it, and showed the percentages of loss due to gases in the firebox, soot on the sheet, the sheet itself, the scale behind it, the film of steam beyond and finally the absorption by the water, claiming that an appreciable percentage of this loss was saved in the Jacobs-Shupert firebox by the cleaner condition in which the sheet was maintained both without and within. He claimed that the smoothness of the sheet enabled the currents of hot gases to sweep over it in such a way that soot was not deposited; also that the curve of the sheet of the units was such that it readily adapted itself to changing temperatures and, by an alteration of form, prevented the close adhesion of scale, breaking it up so that the water would have ready access to the metal. In this way, all the stresses of expansion and contraction set up in the ordinary boiler were nullified. He asserted that on an ordinary 6 ft. sheet the expansion was such that the stresses set up were nine times as great as it was considered safe for the sheet to bear.

In the matter of circulation, he showed that in the ordinary boiler the staybolts set up such eddy currents that the flow of water was greatly impeded, as evidenced by the large amount of scale that was deposited on all staybolts and stays. This was set down to the credit of the Jacobs-Shupert box, by inference.

As for safety, an absolute guarantee against explosion was offered. It was maintained that no matter how low the water might be, and no matter how hot the sheets might become, an explosion could not occur, so strong was the staying of the surfaces. It might be that the sheets would yield and even split, but the split would be purely local and could not extend, and the effect would be no more disastrous than the cracking or collapsing of a tube is at present. Tests were cited where the sheets had been both accidentally and purposely heated to a high temperature and water injected upon them without causing any trouble whatever.

Finally in the matter of efficiency and economy of operation the speaker claimed that tests had shown that boilers equipped with the Jacobs-Shupert firebox had given an increase of efficiency of 35 per cent. over the ordinary boiler, and that, therefore, on all counts of simplicity of construction, efficiency and economy it was in every way superior to the ordinary firebox.

Discussion.—Naturally, in the discussion which followed the soundness of some of these claims was questioned. As to the value of the mechanical method of construction there could be no doubt, though attention was called to the fact that comparative costs were wanting and that first cost rates were in need of more light. It was also conceded that in the matter of safety, that is strength of construction, the Jacobs-Shupert box was probably much superior to the ordinary firebox. The almost continuous stay sheet was certainly stronger than the staybolts and probably less likely to crack.

But when it came to the matter of expansion and its effects, doubts arose. It might possibly be granted that longitudinal expansion would be taken up by the curvature of the units and little additional stress in that direction be imposed. But how about the vertical stresses? When the back tube sheet came up, as it was known to do, what would be the effect of the rigid stay sheet that tended to hold it in on all sides, even though there might be a couple of sling stays at the top and center? Would not the expansion stresses, so set up, tend to crack the tube sheet at the center, and tend also to crowd the tube holes in the upper corners out of round?

As for circulation, it was, of course, allowed that the staybolts and braces did tend to the formation of eddy currents, but

the statement resulted in a boomerang of questions. If the small round staybolts set up so much resistance to the free flow of the water, how much more would be that set up by the square holes in the stay sheets? Here we have all the elements for the formation of the worst kind of eddies, and hindrances of the most serious kind to the easy flow of the water. Not only would the circulation be impeded, with the result that the quieting of the water would produce a serious settling of deposits, but these same sheets would offer the most serious of impediments to a thorough washing out of the boiler. On every count, then, the Jacobs-Shupert firebox seemed to be inferior to the common firebox in the matter of circulation.

The speaker was challenged to show any data whatever that could demonstrate in any way either the direction or velocity of the currents of water in a firebox. Much as such data was to be desired, and valuable as it would be, no one knew of any such experiments that had ever been made and any statements as to the character of the circulation of water in a locomotive boiler were purely a matter of deduction based on general principles and not on actual measurements made in the field.

Finally a flat issue was taken with the statement that the Jacobs-Shupert boiler would show an evaporative efficiency of 35 per cent. above that of the ordinary firebox. These figures are so far above the wildest claims of any advocates of all other locomotive improvements that they must be at fault. Even the greatest enthusiasts of compounding, of superheating, or of both and all other things combined, have hardly presumed to put the resultant saving as high as 35 per cent. It was suggested that possibly the gentleman had made a mistake and slipped a decimal point and that he really meant to say 3.5 per cent., but even this would have to be proved before it could be accepted. The result was, that while the apparent merits of the new type of firebox were admitted, the acceptance of all the claims made for it, was considered to require a better demonstration of their validity than had been given.

In closing the discussion Mr. Whiteford made no reply to the criticism on his assertions, but offered to furnish evidence to substantiate his statements, to all who might ask.

As no report was made on the standardizing of shop tools and equipment, or upon the standardizing of pipe flanges on boilers and templets for drilling them, these subjects were passed.

BRICK ARCHES.

Taken as a whole, the report of the committee and the tone of the discussion that followed were decidedly in favor of the brick arch for locomotive fireboxes, both on the score of boiler maintenance and the economical use of fuel, though there was some question as to the economy as a whole. One of the claims made for the brick arch was that it served as an efficient means of protecting the tube sheet from the drafts of cold air and thus prevented leakages.

There was some discussion as to its proper location relative to the tube sheet. At the opening of the discussion the opinion was expressed that a slight space should be left between the brick and the sheet to prevent an accumulation of cinders that would be apt to block the lower tubes. The width of opening to be left was variously placed at from 2 in. to 6 in., with somewhat of a preference for the smaller spacing. Then came a statement that the Lake Shore & Michigan Southern was using brick arches that were carried on arch tubes and were set up close against the tube sheet. In order to prevent an accumulation of cinders, the bricks are cut away at the corners and there is no difficulty whatever. The bricks are put in in short sections, so that a portion of the arch can be easily removed, if necessary, in order to do work in the firebox. Speaker after speaker then endorsed the use of the brick arch set close against the tube sheet.

There were a number of questions as to the effect of the brick arch on the side sheets. No evidence was produced to show that the side sheets were any more apt to crack when a brick arch was used than when it was not, and most of the men using it were decidedly of the opinion that it had no injurious effects. While some of the members maintained that no difficulty had been experienced, even when the arch had been set close against seams, there were others, and they constituted the majority of those who spoke, who thought that it would be best to allow a clearance between the brick and the seam of from ½ in. to ⅝ in. This would correspond with the average practice relative to side sheets and would insure a complete absence of all troubles at the seams. One case was cited where an arch had been set in tightly against a seam which started to leak and where the trouble had been stopped, not to reappear, by giving the clearance recommended.

This also holds true as to patches, and one member stated that he had used the brick arch long and successfully in patched fireboxes. It was further maintained that where a cracking of the side sheets did occur, it was probably due to bad water rather than the brick arch; as every one knows, bad water is a prolific cause of sheet cracking. In following up this argument it was maintained that the brick arch would actually tend to prevent the sheets from cracking, and that it was a good thing for such sheets. It was maintained that there were no more leaky staybolts with a brick arch than there were without it.

On one point there was a general agreement, and that was that it is not well to run the arch up too close to the crown sheet. If this is done, the intense heat of the flame, as it turns over the top of the brick, will be apt to cause a leakage of the cross stays. These conditions are apt to arise if the space is cut down to from 14 in. to 16 in., and it is well to always maintain a distance of at least 18 in. to 20 in., if trouble with the crown stays is to be avoided.

As for economy of operation, that is economy in the use of coal, it was generally acknowledged that the brick arch made such a saving possible. This was based on sound scientific principles, provided the arch was properly installed and worked. One speaker cited an instance where an engine had burned from 6 to 7 tons less coal on a round trip over a 160 mile division after the installation of the brick arch, and claims were made of savings of from 8 to 10 per cent. On the other hand, one case was mentioned where eight engines had been equipped with brick arches—all alike and all engaged in the same service. The arch was removed from one of them, and none of the other seven ever succeeded in equaling that one in the economical use of coal.

It was insisted, too, that to obtain any degree of success with the brick arch, it must be properly installed. It must not only be put in the proper position in the firebox, but the draft appliances in the smokebox must be adjusted to its use. It is impossible to use the arch without making changes in the location of the diaphragm and other parts. When this is done, the arch must be properly and efficiently maintained. If these precautions are taken it will be a success.

As for the use of the arch in shallow fireboxes, there was a difference of opinion. The representative of one road stated that it was using it on all locomotives, large and small and with deep and shallow fireboxes, with universal satisfaction. Another claimed that the arch had no place in a shallow firebox. The bed would be up against the bottom of it, the coal would not burn and trouble from lack of steam was without end.

As for ultimate economy no figures were given and the doubt was raised whether when the cost of the arch tubes and the brick and the labor required for maintenance and replacements were taken into consideration there would be a sufficient saving in coal consumption to pay for this cost. One speaker even stated that he knew of a case where it cost as much to maintain the arch tubes used with the brick arch as it had previously done to keep up the fire tubes.

Further, in the location of the arch, special attention should be paid to the character of the water used, as it has been found that the height of the arch, to give the best results, depends

largely on the water supply, and it should be raised or lowered accordingly.

The brick arch has been and is in successful operation with all grades and qualities of bituminous coals from the high class output of the Pittsburgh district, through the various degrees of Indiana, Illinois and Iowa coals, to the lignites of Wyoming. But for each a special adaptation must be made; an arrangement that will give the best of results on one road with one grade of coal and one class of service, will be the rankest of failures elsewhere, where conditions are different.

The whole discussion may be summarized in the general statement that a concensus of opinion of the members present approved of the brick arch as an economical device. That it should be properly installed and maintained; that it had best be set close against the tube sheet with a slight clearance between it and the side sheets; that it should be carried on arch tubes and be composed of short sections; that it should be kept well away from the crown sheet; and that the draft of the engine must be adapted to it, and that, if these conditions are complied with, it will be an economical adjunct to the locomotive.

OXY-ACETYLENE WELDING.

In the report on the Advantages and Disadvantages of Using the Oxy-Acetylene Process in Making Repairs to Boilers, M. F. Courtney, chairman of the committee, stated that attention was first directed to the matter on the Great Northern about five years ago, when it was used in an experimental way for the making of light boiler repairs. The work was successful, and it was decided to go into it more extensively, the tin and copper department being chosen to take it in hand, because it was thought to be along the lines in which that department was working and that brazing and soldering had much in common with this new process of welding.

The success was so great that a generating plant had to be installed. This was done and pipe connections were laid to all pits in the boiler and the machine shops. A corps of men was instructed as to the methods to be followed in making a successful weld. The success or failure of this device depends almost entirely on the intelligence displayed by the operators.

The manner of procedure in repairing a crack in the firebox is as follows: The crack is V'd its entire length at a bevel of 45 deg. In choosing the filler it was found that ¼ in. round best Swedish iron was the most satisfactory. The torch is applied, heating the sheet and filler together, the melted iron dropping into the groove until it is filled up; the torch is again passed over it, melting the surplus metal off and making a smooth solid weld. The average amount of this kind of welding which is done per hour is one foot. In this kind of work, the acetylene is supplied at a pressure of 4½ lbs., with the oxygen at 12 lbs. This proportion has given the best results. To put in a whole or half side sheet, or a patch of any dimensions, the procedure is the same as described above, the sheets being cut with an edge bevel of 45 deg.

A comparison of Swedish and Ewald iron as a filler may be of interest. Swedish iron with a cross section of 2.5 in. by .401 in. has a tensile strength of 34,500 lbs., while Ewald iron with a cross section of 2.5 in. by .402 in. has a tensile strength of 28,400 lbs. Seams welded as described have an efficiency of about 90 per cent.

The oxy-acetylene process is an admirable cutting agent, a ⅝-in. plate being cut at the rate of 22 ft. per hour. This cut is just as clean as if it had been made with a saw. In cutting, acetylene used at 4 lbs. and oxygen at 60 lbs. pressure.

Some of the work that is now done by this process consists of welding cracks in mud ring corners, of filling worn places on boiler sheets to their original thickness, filling staybolt holes and redrilling them again, welding links and motion work, and in general, repairing any fractures.

An interesting development of this process came to light some time ago during the construction of 600 track leveling gages of a new design. The carriage frames for these were made of ⅝-in. and 1-in. steel bicycle tubing, and necessitated the welding of 27,000 joints. The oxy-acetylene method was employed and better results were obtained than if the frames had been brazed.

Another interesting use is the welding of cast iron. A characteristic of cast iron is its free or uncombined carbon, which makes the welding so difficult. However, this is overcome by using a flux of the following formula:

Otho boracic acid, $H_3 B O_3$	15 parts
Chlorate of potash, $K C L O_3$	5 parts
Oxide of iron, $F E_2 O_3$	3 parts

This mixture is pulverized and kept perfectly dry. A filler is used composed of rods of cast iron rich in silicon. These act as a solder when melted; the rods are usually about ⅜ in. in diameter. The work done in cast iron consists of repairs made to the broken parts of machinery. Blow holes or defects in the cylinder or other castings are filled up, and cracked spokes on driving wheels are repaired, even to the extent of welding in complete new spokes when the old ones are broken out.

Discussion.—In the discussion there was the same enthusiastic endorsement of the process, but tempered with recitals of failures and the emphatic assertions repeated time and again that the work was not one for a novice to undertake; that for its successful accomplishment, skill and judgment were necessary, and that these could only be acquired through a long course of practice and experience. With these acquired there was practically no limit to the scope of what could be done. Pits on tubes could be filled; twenty-five tubes a day, averaging ten large pit holes each, could be repaired; cracks in tube sheets could be mended—cracks not only in the flanges but in the bridges; door plates can be replaced, and the rounding corners of the firebox repaired. The scope was almost universally comprehensive, and as speaker after speaker told of his successes, there came similar tales of failures and demands for information as to how the work was done.

The welding of cracks in the side sheets of the firebox seemed to be the most common feat, and yet some had had the sheets pull apart not only at the weld, but in the solid metal as it cooled. It then appeared that success was attained by providing against this contraction in one of two ways. One was to keep a stream of water running down the face of the sheet a couple of inches from the crack on each side. This limited the heated zone to a few inches, reduced the total contraction, and with it cut down the resultant stress.

The other method was that involved in the placing of a patch. A number of men said that they had had no difficulty with the longitudinal welds, while the vertical welds were more than apt to fail. Success was attained by putting a corrugation in the patch and arranging it so that a staybolt would come in the center of it. The bolt when drawn home would then pull the crest of the corrugation in, tending to put the sheet in compression and thus compensate for any contraction that might arise in cooling. At first the corrugation was given a height of ⅜ in., and a width of 1⅜ in., but it was found that this was not quite enough. It was increased to a height of ½ in., and a width of 2 in., which serves its purpose admirably and prevents all pulling apart of the weld or sheet. Another point to be observed is the sequence of doing the work. In putting in a patch in a side sheet, it is well to weld across the top first, then down the side 4 or 5 in. at a time, alternating from one side to the other.

One piece of work that seemed to be the easiest in which to attain success was that of filling staybolt holes when the holes had become too large, and then drilling afresh for the bolt.

As opposed to this was one job that had proved so much of a stumbling block to so many that it seemed, for a time, to mark the impossible. It was the welding of bridges in the tube sheet. One tale of woe followed another in rapid succession, of how as soon as one bridge was welded, two or three others in the vicinity would break. Water had been used for cooling;

the sheets had been packed with clay, asbestos and every conceivable precaution had been taken to no effect. One member, in describing his process, said that he merely V'd out the crack, cutting clear through and leaving a gap of a full ⅛ in. between the parts. He then welded by flowing in in the usual manner. Occasionally he had had a failure and an adjoining bridge had cracked. But the man who did not have a failure welded the bridge as any other crack, and then put a roller expander in the holes, starting two or three holes away from the repaired bridge, and rolling out the holes, circling around the mended bridge, and working in towards it, keeping the scale starting until the sheet was perfectly cold. This enlarged the holes slightly, but it prevented the secondary cracks from forming.

Then came the subject of welding in tubes. No one seemed to be able to make a success of it. One man had welded in a complete set of 391 tubes, that made four round trips and then failed so utterly that they had to come out and with them the tube sheets. Others had welded all the way from a few tubes to a half set, but without obtaining a satisfactory result. The method had been to either try to weld in the tubes as a whole, or to expand them in and weld on a bead, or to expand and bead by the usual manner and then weld the bead to the sheet, but none of these processes spelled success.

Finally, a member told of how, in building a new boiler he had welded in a full set of tubes that was a success in every particular and had now been running for several months. The work had been done by turning the boiler up on end, so that the tube sheet was horizontal. Then the torch had been applied and allowed to burn down deep into the metal. The depth of weld thus obtained was far greater than would have been possible with the sheet vertical. He attributed the failures in tube welding to this failure to get a sufficient depth of weld, and thought that the up ending of the boiler was the only way in which it could be done.

One point, however, on which the successful welders were agreed, was that old material was very much more difficult to weld than new, and that the welding of very old tube sheets, where the original structure of the metal had been changed and become coarsely granular, was almost impossible and had best not be attempted.

It was suggested in this connection that fewer failures would result if the metal were preheated to redness before the welding was started and then reheated and annealed after the work had been done, but this did not seem to meet with wide approval as a practicable scheme.

The result of the discussion indicated that there is hardly a line of boiler repairs that can not be successfully accomplished by the oxy-acetylene process in the hands of a skillful operator, and that for cutting out sheets, taking out fireboxes and work of that character there is nothing to equal it.

BEST METHOD OF APPLYING TUBES.

The report of the committee on The Best Method of Applying Tubes, the Best Method of Caring for Them While Engines Are on the Road and at Terminals, and the Best Tools to be Used, consisted of a series of recommendations bearing on these points.

The first to be considered was that of the preparation of the sheet. The recommendation was made that the hole should be thoroughly cleaned, and rounded on each edge with a fillet of not less than 1/16 in. radius. The ferrule should then be properly annealed and applied in the sheet flush with the fire side with a ferrule expander having a slight boss of about 1/32 in.; or it should be lightly rolled in. Care must be taken that the ferrule is not opened or belled out on the water side, but should hug the tube tightly when the latter is put in. In order to cover the expansion of the tube a width of 1 in. is recommended for the ferrule.

The end of the tube should be swedged down to a diameter ⅛ in. less than the body; it should be annealed and the ferrule should be of the proper thickness to make the tube a snug fit. The wear or enlarging of the hole should be taken up with copper until the hole is considered too large or the tube sheet bridges get too weak for further service. The tube should be driven in ¼ in. past the sheet for the bead and then be pinned out and expanded and rolled light by hand and then beaded; the tube should not be turned over other than it is by expander, which should be one of 30 deg.; the beading tool to be a standard tool. Tubes should be annealed on the front end and shimmed or opened up to fit the hole and beaded to stay 50 per cent. of the sheets.

In order to obtain the best results on the road an effort should be made to have the boiler fed as evenly as possible, and to so maintain the fire that cold air will be prevented from entering the firebox as far as possible. If water is to be put in while the engine is on the side track, it should be done in small quantities. Above all the fire should not be allowed to die out before water is fed.

While engines are at terminals the boiler should be filled with water while the fire is in good condition and the fire should be knocked out without the use of the blower. The engine should be equipped with grates in the way of a dump and shaker so that the dump on the outside grate frame can be opened and be held so, while the shaker is used to work the fire out. The ash pan should be cleaned and closed and the air pump be shut off so as not to form a suction through the firebox and the tubes. The fire door should be kept shut as much as possible at all times. When the engine is to be washed, it should be cooled down by blowing off steam at the dome and the water should then be drawn out after which it should be washed with hot water, of not less than 120 deg., and then filled with water at an even higher temperature.

When engines have work to be done in the firebox they should be cooled slowly, the steam being blown off at the dome, and, if it is necessary to put in water, it should be done at the top of the shell and as near to the front tube sheet as possible.

In raising steam, the fire should be started in ample time to permit getting the engine hot and to have a good fire covering all parts of the grates before the forced draft or blower is used.

The best tools recommended for the work are first the expander, the roller to be the last to be resorted to. A standard beading tool should be maintained at all times, and when the tube has been worked until too much metal has been forced out into the bead for the tool to cover, the surplus should be cut off. A light hammer should be used for expanding the tube, and care should be taken not to drive the expander pin any harder than is absolutely necessary in order to avoid the stretching of the bridges of the tube sheet and thus force it up.

Discussion.—In the discussion the chairman of the committee, D. A. Lucas, emphasized the desirability of a wide and heavy ferrule. He advocated using 60 lb. copper 1 in. wide, and to support his position showed sections of tubes and sheets where light and heavy ferrules had been used. In the latter the ferrule was apt to bell out on the inside forming a pocket for the entrance of scale and so preventing a full bearing on the tube. With the heavy ferrule there was a close contact well back of the sheet, thus cutting off at its very start the originating point of a leak, which is between the tube and the ferrule. An instance given to show the effectiveness of this ferrule was that of an engine, fitted with the usual thin and narrow ferrules, that only made 7,000 miles before the tubes had to be removed. A wide, heavy ferrule was then applied and the tubes made 96,000 miles before it was necessary to remove them. However, if the wide ferrule is opened or belled on the inside it fails to perform its proper functions and may as well not be used. It is necessary, therefore, to exercise the greatest vigilance in order to prevent this. If the tube does not enter readily, it is easy for the man in the firebox with his heavy bar to roll out the lip of the ferrule for the tube to enter. This should not be done. The ferrule should be made to fit the tube and the tube made to enter it properly.

If a ferrule is brazed to the end of the tube, its function is

destroyed. Leakages are caused by variations of temperature and by the tube shrinking away from the ferrule. If the two are brazed together, the tube will certainly carry the ferrule with it when it contracts and draw it away from the sheet. These were some of the arguments presented for the wide ferrule. On the other hand it was stated that the experiments had been made using wide and narrow ferrules in the same engine and that accurate records of their performances failed to show that there was any difference between them.

Attention was also directed to the origin of the copper ferrule. It came in with the disappearance of the copper tube sheet, when it was felt that there must be a soft filler to enter all of the inequalities of the tube and the sheet and so make a tight joint, and that possibly it might not be a necessity. But very little information was elicited regarding the steel ferrule, one member condemning it and another stating that, after six months' service, a set that had been put in was still all right.

An inquiry was made as to the practice of the Lake Shore & Michigan Southern of swedging down the firebox end of the tube. In reply it was stated to be the practice on that road to swedge a 2-in. tube down to a diameter of 1⅞ in. for a distance of about 4 in. from the end. The advantages claimed are that the tube sheet lasts longer because of the wider bridge that is obtained; that the better circulation so obtained prevents the sheet from bulging; that the increase of metal in the bridges gives an added strength to prevent stretching when the tubes are rolled; that a better draft is obtained by having a larger sectional area of tube at the center than at the end, and that there is less difficulty of clogging with cinders.

In the final analysis, however, it was generally agreed that leaky tubes and cracked sheets were due not to bad material and poor workmanship, but to bad water, improper spacing of tubes and irregular feeding. Of the three the most prolific cause of trouble was bad water. Cold air entering the ash pan and door should be avoided, but its influence was insignificant compared with the feed and the water. If good water were to be provided and that good water were to be fed regularly, the trouble with tube leaking would soon disappear. As an example of this, two boilers were mentioned. They were on the same run, yet the careful work of one engineer gave a tube life in one of 16 months as compared with 8 in the other.

STEEL VERSUS IRON TUBES.

From the report of the committee on Steel versus Iron Tubes and the Success in Welding Them, it appears that there is but little to choose between them and that that little is in favor of the steel tube. The steel tubes are apt to be a little more brittle and tend to break back of the weld when safe-ended. There is not, however, much difference in the mileage to be obtained. In a recent test in which sets of steel and iron tubes were compared it was found that at the end the total cost of the iron tubes was somewhat more than the steel, and that there had been fewer engine failures with the steel. More care is required to weld the steel than the iron tubes, and the steel tubes seem to collect more scale.

It was brought out in the discussion that in the case where the steel tubes had seemed to collect the most scale, they had been on the right hand side of the boiler where the greater amount of water had come from the injectors, so that the test could not be regarded as conclusively proving the point.

One of the objections raised to the iron tube was its tendency to split, and cases were given of iron tubes spliting back from 18 to 20 in. from the ends when an attempt was made to roll them out.

As a general rule the members were using steel for safe ends, even on iron tubes, though Swedish iron was also used. For the tubes themselves the seamless steel was preferred, both for the service it would render and the ease of welding. As for the difficulty of welding steel, every member who took part in the discussion disclaimed having had any trouble whatever.

Attention was called to the necessity of carefully cleaning the interior of tubes before expanding them, especially iron tubes. If this were not done it was found that the coarse particles of coal and cinder would be embedded in the metal or even driven all of the way through it, so as to cause a leak.

As for pitting it was generally conceded that steel tubes pit to a greater extent than iron, and yet a case was cited of a test on the Chicago & Northwestern where a boiler had been fitted with a half set each of steel and iron tubes, and that of these 6 steel and 49 iron tubes had been scrapped for pitting. On another boiler on the same road just the reverse had occurred. Generally speaking the longer the tube the greater the amount of pitting, and while some pitting would occur at the firebox end within 18 in. of the tube sheet, the most vulnerable and common point of attack was at the bottom of the lower rows of tubes at the front end.

One speaker maintained that pitting was accelerated by a variation in the regularity of the feed, due to a possible stagnation of the water at the bottom of the shell. The greater heat at the rear end of the tubes would tend to keep up a more active circulation at that point than would be likely to exist at the front end when the feed was shut off, and hence the increase of pitting at the front. The same explanation would hold for the difference in pitting at the top and bottom of the tubes.

It was stated that a great deal of the trouble with tube pitting could be avoided if the tubes were kept clean and free from rust before they were applied. On the whole the members seemed to agree with the committee that better service could be obtained with the steel tubes, that their heads retained their strength better and that they were less likely to leak.

BEST METHOD OF STAYING CROWN SHEETS.

The fact was recognized that the working of the tubes in the back sheet tends to make the latter rise and carry the crown-sheet with it, or to turn down the flange so that it makes an acute instead of a right angle with the face of the sheet. One of the means used to overcome this difficulty was to put a sort of ogee in the top of the tube sheet, running it out to the corners and omitting 29 tubes. Three sheets of this kind were put in engines four years ago. Two cracked, but the third is still in good condition. Another method suggested and used, was to turn the flange of the tube sheet back so that it made an obtuse angle with the face of the sheet when new, and to turn down the end of the crown-sheet to meet it. Then, as the top of the tube sheet was sent up by the work done on the tubes, the flange would be bent down, gradually approaching a right angle, but avoiding the acute angle bend that is the cause of so much trouble and cracking.

Very little was said about the sling stays that are used at the front end, as their presence was taken for granted, but it was stated that a good deal of trouble originated in having the T-bar for the stays too rigidly attached to the crown-sheet, and in a way that might cause their ends to be pressed down on the sheet by the slings.

Finally, there was a little discussion as to the proper radius for the flanging of the tube sheet. While it was conceded that too short a radius would be apt to cause cracking, it was recognized that the same trouble would occur if it were too long, and a great deal of trouble had been experienced where a 3-in. radius had been used. While no action was taken, a radius of about 1½ in. may be given as representing the prevailing idea of what is proper.

ELONGATION OF FLUE HOLES AND THE COMBUSTION CHAMBER.

The cause of the elongation of the flue holes in the sheets was recognized as due to the prossering of the tubes and the stretching of the metal of the sheets moving along the lines of least resistance. It was also claimed that the rigidity of the fastening of the sides of the back tube sheet had an influence in this matter, as indicated by the fact that the holes in the front tube sheet do

not elongate, nor do tubes elongate in the tube sheet of a combustion chamber.

The combustion chamber was barely touched upon and that merely to indicate that it was an undesirable adjunct from the boiler makers viewpoint.

The subject of the standardizing of blue prints was passed as there was no report.

COMMITTEE ON SUBJECTS.

The committee on subjects recommended a number for the meeting of 1912, the majority of which are merely repetitions of those discussed this year. The reason given for this being their great importance. These subjects are as follows: Best Method of Applying Flues, Best Method of Caring for Flues while Engines are on the Road and at Terminals and the Best Tools for This Work. Steel vs. Iron Flues, What Advantages and What Success in Welding Them and the Effect of Length of Tube on Maintenance. Best Method of Staying the Front Portion of the Crown Sheet on Radial Top Boilers to Prevent Cracking of the Flue Sheet in the Top Flange. Cause of Flue Holes in Back Flue Sheet Elongating and a Preventative for it and the Effect of the Use of the Combustion Chamber. What are the Advantages and Disadvantages of the Use of Brick Arches and Arch Pipes in Locomotive Fireboxes? What are the Advantages or Disadvantages of Using the Oxy-Acetylene Process in Making Repairs to Boilers? What Can Be Done to Produce Better Circulation in Marine Return Tubular and Vertical Boilers? Apprenticeship? When is a Locomotive in Its Weakened Condition? Feed Water, Location of Admission and the Results Obtained. Smoke Prevention, Spark Arresters and Grates. Superheating Steam and Its Relation to the Upkeep of the Boiler.

At the discussion on the revision of the constitution it was voted to drop the word "International" from the name, so that the association will be known in the future as the "Master Boiler Makers' Association."

ELECTION OF OFFICERS.

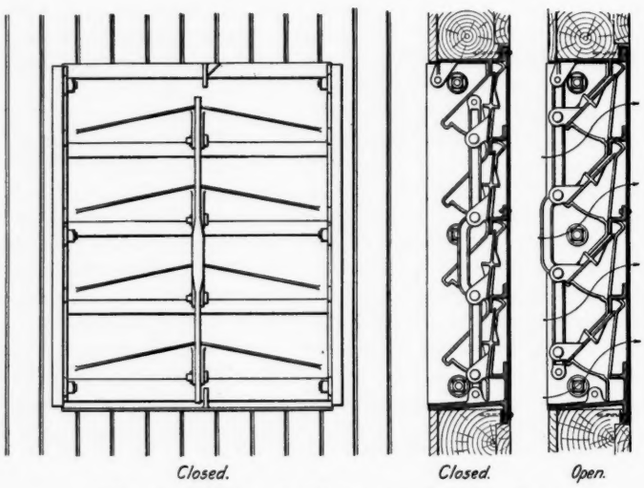
At the election held at the close of the meeting, the following officers were chosen: President, Geo. W. Bennett, N. Y. C. & H. R., Albany, N. Y.; first vice-president, James W. Kelly, C. & N. W., Oak Park, Ill.; second vice-president, M. O'Connor, C. & N. W., Missouri Valley, Iowa; third vice-president, Thomas W. Lowe, C. P .R., Winnipeg, Manitoba; fourth vice-president, J. T. Johnston, A. T. & S. Fe, Los Angeles, Cal; fifth vice-president, Andrew Greene, C. C. C. & St. L., Indianapolis, Ind.; secretary, Harry D. Vought, 95 Liberty street, New York City; treasurer, Frank Gray, Bloomington, Ill. For members of the executive committee: C. E. Rogers, E. W. Young, A. E. Shaw, J. A. Dornberger and C. L. Hemphill.

THE ALLEN CAR VENTILATOR.

The Atlantic Coast Line has specified a new type of end ventilator for the 1,400 ventilated box cars being built by the American Car and Foundry Company, New York, which overcomes the objections in the types of ventilators now generally in use on box cars. It was designed and a patent has been applied for by G. L. Allen, chief draftsman for the Atlantic Coast Line, Wilmington, N. C.

The ventilator now in general use consists of grating in the end of the car made with a wooden frame, vertical wrought iron rods and wire netting. It is closed by a wooden door sliding on a wrought iron track and is secured in the closed position by metal guides at the bottom of the door and a set of ordinary door fasteners. The objections to this style of ventilator, which it is believed the new ventilator will overcome, are: The high cost of maintenance, due to its being constructed principally of wood and secured by a number of bolts, forgings and castings; the cost of replacing lost doors; the fact that shifting loads, such as dressed lumber, easily break the grating and its wooden frame; when the ventilator is open the contents of the car are not protected from rain; in order to guard against accidental opening of the doors (due to defective fasteners) and the contents of the car being exposed to damage by rain or sparks, the wooden doors are often nailed in a closed position and the ventilator is thus rendered useless; and the interference of the door with the location of the brake step and the end ladder clearance as required by the recent safety appliance law. When lower ventilators are used they also interfere with the location of handholds required by law.

The Allen ventilator, as shown in the accompanying illustration, is simple in construction and is made of malleable iron. Its general appearance is neat, it being nearly contained within the thickness of the car wall and occupying a space only about 2 ft. wide in the middle of the end of the car. The essential features of the ventilator are: A main frame having flanges inside of the car on all four sides; Z-shaped horizontal bars cast integral with the frame, which lap over the top of the movable plates, strengthen the frame transversely and back up the wire netting; and movable plates, pivotally connected at the middle by an operating rod. The movable plates are not hinged or pivoted to the frame, but merely rest at their ends in recesses in the sides of the frame. The ventilator is held in open or closed position



Allen Ventilator Applied to a Freight Car.

by gravity and needs only to be pulled open or pushed closed, in each case exerting a slight lifting force on the handle. The holes which are shown in the ends of the operating rod and in the lugs at the top and bottom of the frame, are provided for sealing the ventilator.

It does not interfere with any form of end bracing, whether horizontal or vertical, and being constructed of metal throughout is well adapted for use on cars of all-steel or composite design. The movable plates when in open position stand at an angle of 45 deg., their lower edges in line with the upper edges of the Z-shaped bars below them, thus making the ventilator rain-proof whether open or closed. The slanting plates also tend to deflect sparks. The ease with which the ventilators may be operated makes it possible for trainmen to manipulate them while the train is in motion. This is an advantage in case of through trains where the trainmen may pass from one car to another, and from the running board or roof of an adjoining car, open or close the ventilator by means of a rod fitted with a hook. The netting is applied on the inside, as is usual, being crimped over the ventilator flanges on all four edges and held securely in place by nails or bolts through the flanges and the netting.

A section of 50 miles of the River Mulatos to Potosi Railway, Bolivia, was opened to public service on March 1.

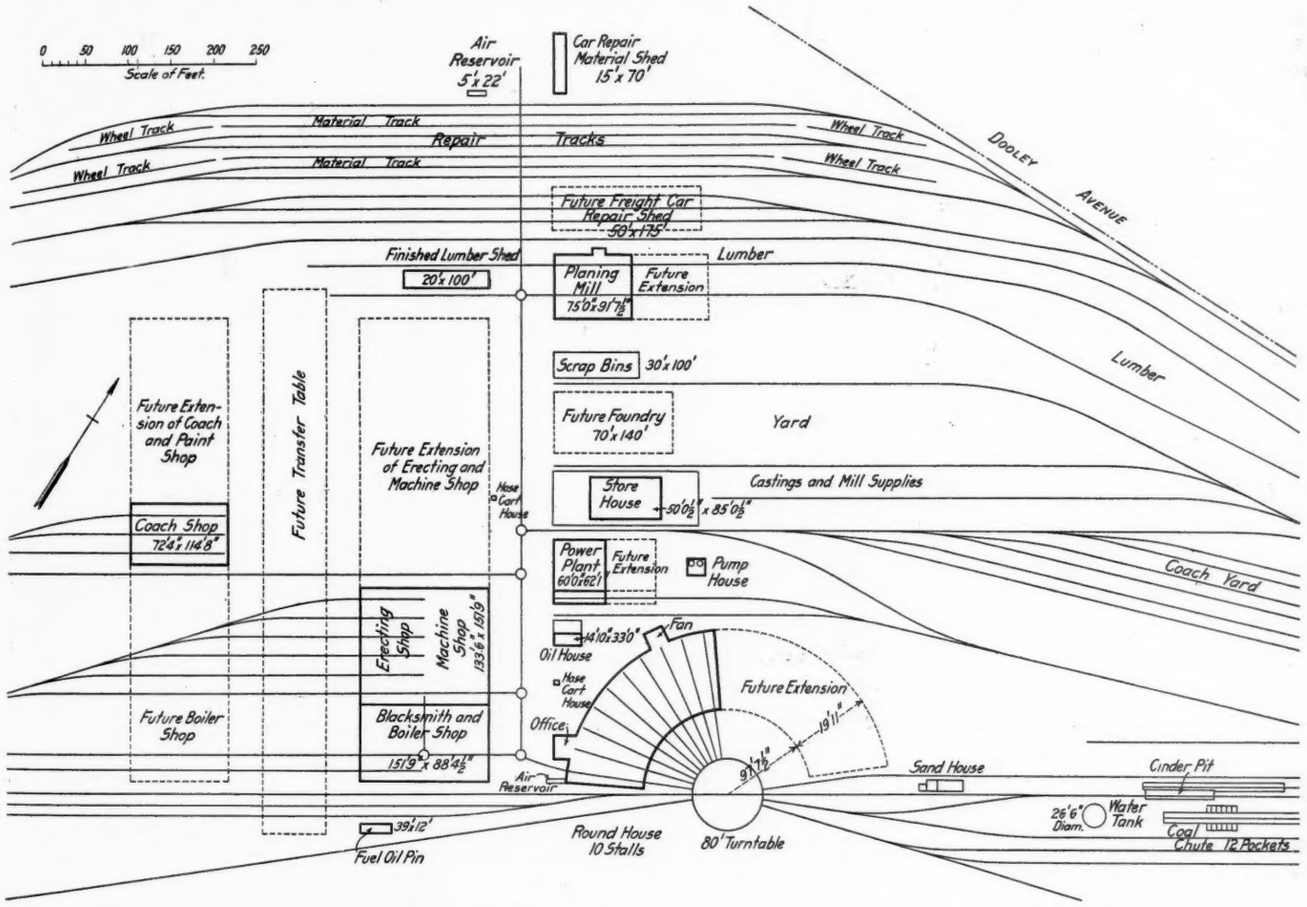
REPAIR SHOPS AND LOCOMOTIVE TERMINAL; KANSAS CITY, MEXICO & ORIENT.

The Kansas City, Mexico & Orient will eventually form an important link between Kansas City, Kan., Texas and the Mexican Pacific coast by a route 1,659 miles long, terminating at Topolobampo, Mexico. More than half of this, or 882 miles, is now constructed and in operation, 510 miles of which comprises the northern section between Wichita, Kan., and San Angelo, Tex. Wichita was selected as a site for the principal locomotive and car repair shops for the northern end of the system, and comprehensive plans have been made for developing here the principal facilities for rolling stock repairs which will be needed when the railway is entirely completed and in operation. A tract of land of about 760 acres has been secured about 3 miles from the center of Wichita and adjacent to the main line, and the buildings indicated by the heavy lines on the plan have been erected.

The completed plant will include the general repair shops and the division locomotive terminal. The latter will ultimately consist of a 40 stall roundhouse with an 80 ft. turntable. The locomotive shop, when finally completed, will be more than 500 ft. long and will contain 20 erecting pits; it will include the machine shop and the erecting shop, in parallel bays. Directly west of the locomotive shop will be a 75 in. transfer table with a runway about 630 ft. long; and beyond this is to be another building about 500 ft. long, the northern portion of which will be the coach and paint shop, while the southern portion will be used as the boiler shop. To the north of the roundhouse are the power station, the storehouse, foundry, planing mill, and the freight car repair shed, with lumber sheds and scrap bins conveniently located.

The buildings so far erected are mostly only of sufficient capacity for initial needs; but each one is so built and located that its enlargement can readily be effected as indicated on the general plan. The locomotive terminal for present needs includes a 10-stall roundhouse with an 80-ft. turntable, 12-pocket coaling station, sand house, 160,000 gal. water tank, and a cinder pit. The repair facilities which have thus far been provided include a locomotive repair shop building that includes a boiler and blacksmith shop, machine shop and erecting shop; a power house, a coach repair and paint shop, storehouse, planing mill, and two sheds for storing rough and finished lumber; also, an oil house, a pump house for the water supply system, and three hose houses.

Engine House.—The roundhouse is located far enough from the main line track to allow room for a freight yard of 8 tracks, when the full circle of the house is completed. The walls are



Arrangement of Locomotive and Car Repair Plant and Locomotive Terminal of the Kansas City, Mexico & Orient at Wichita, Kan.

of brick with a wooden roof supported on timber posts. The roof is nearly flat and is of wood sheathing with 4-ply tar and gravel covering. In each stall is a pit 61 ft. long built of reinforced concrete resting upon a reinforced concrete mat foundation extended to an extreme width of about 10 ft. The concrete pit side walls are 2 ft. thick. Each rail rests on one 8 in. x 12 in. stringer, and alongside it is a separate 12 in. x 12 in. jacking stringer. Two stalls are fitted with driving wheel drop pits, while the third one from the south end is fitted with a truck drop pit. The drop pits are built of reinforced concrete and are fitted with hinged rails. The smoke-jacks are of asbestos lumber. The house is heated by the indirect fan system, using exhaust steam, the fan being located in a small brick addition from which air is forced into a system of concrete and tile ducts radiating to the various pits. The capacity of the fan is sufficient to change the air in the roundhouse every 10

minutes. The artificial lighting is by means of 9 3-light clusters of 16 c. p. lamps and 33 single 32 c. p. lamps. Wall plugs are distributed about the pits and on the walls and posts for extension lamp cord connections.

Cinder Pit.—On the track north of the coal pocket is the cinder pit. Because of the difficult drainage and soft soil it is of somewhat special design. There is a single track slightly elevated, one rail resting on wooden blocks set in a concrete stringer about 5 ft. deep, the other on a 15-in. I beam carried on concrete posts; the whole is supported on a reinforced concrete mattress 15 ft. wide and 8 in. thick, the bottom of the mat being about 4 ft. below grade while the rails of the track are about 2 inch above grade. The cinder pit is brick paved on a cinder bottom and is only 6 in. to 9 ft. below the ground level.

Locomotive Shop.—This is a steel frame building, about 152 ft. x 220 ft., with brick walls and a wooden roof. The erecting shop and machine shop are in three parallel bays, with the boiler and blacksmith shop running across the south end of both and separated from them by a brick fire wall. The erecting shop pit walls are of concrete, 2 ft. thick and capped by 8 in. timber stringers.

The erecting shop is 132 ft. x 76 ft., and accommodates 6 erecting pits with separate entrances through the west wall of the building. The clear height of the roof trusses above the floor is 41 ft. 6 in. The shop is designed for a 120-ton traveling crane, the span between centers of the crane rails being 71 ft. 3¼ in. The crane runways are supported on steel columns. The roof is slightly pitched and without a monitor. The upper tier of windows on the west wall runs up practically to the eaves, providing ample light for the entire floor area. The side walls are of brick in the lower story, the upper portion being of plaster on special galvanized expanded metal.

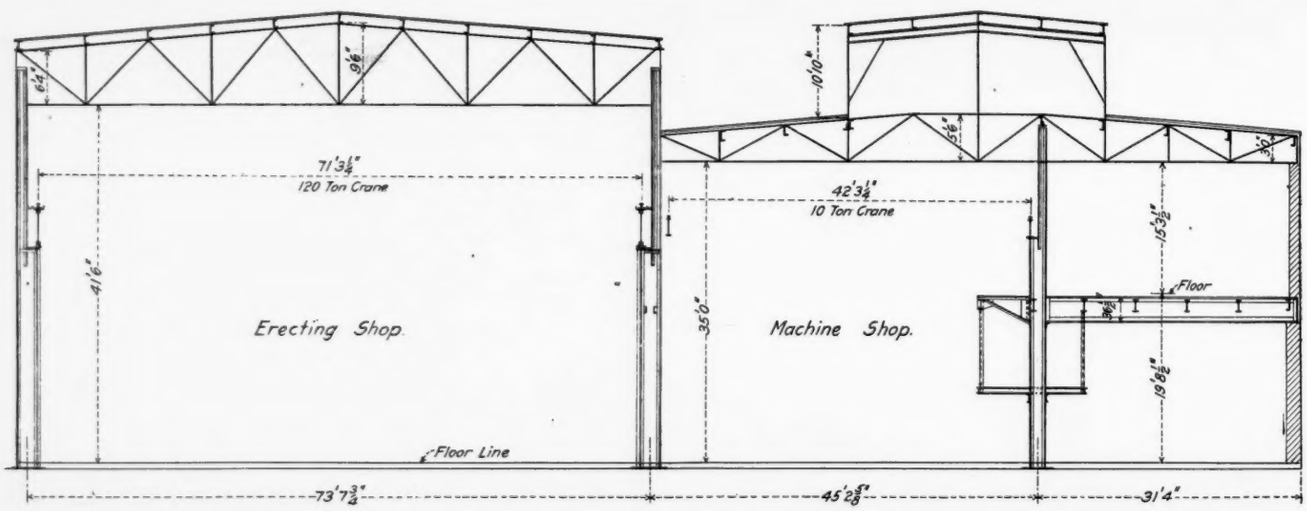
The machine shop is built in two longitudinal sections, that over the heavy machine floor being served by a 10-ton traveling crane running the entire length of the shop over the large tools, the other section having a gallery running its entire length, and without crane service. There is a small mezzanine gallery at each end of the latter, one containing a foreman's office and the other the men's lockers and lavatory. The machine shop has a monitor roof 10 ft. high.

The boiler and blacksmith shop is of but one story with deep roof trusses, there being a monitor roof 10 ft. high over each shop. There are two tiers of windows around the three sides of the shop and it is thus well lighted.

The artificial lighting of the main shop is accomplished primarily by 23 type P 700 c. p. Cooper Hewitt lamps and 18 type H-300 c. p., Cooper Hewitt, lamps, supplemented by a number of incandescent lamps run from wall plugs on the walls, columns and pits.

A portion of the machine tools were formerly used in another shop, and a number of modern ones were added for present needs. They are mostly operated from direct current constant speed electric motors in group drives. The driving wheel lathe is driven by an individual variable speed motor. Other motor driven machine tools are later to be added to the equipment. Due consideration was given to the merits of both the alternating and direct current systems for operating these shops, but the fact that direct current is necessary for the proper control of variable speed machine tools, the undesirability of having two systems in the present installation, and the general nearness of the shops to the power station, all influenced the decision in favor of direct current on the 220-volt, 3-wire system. There are five group drive motors, two being of 40 h. p., two 25 h. p., and one 13 h. p., all of the 220 volt open type.

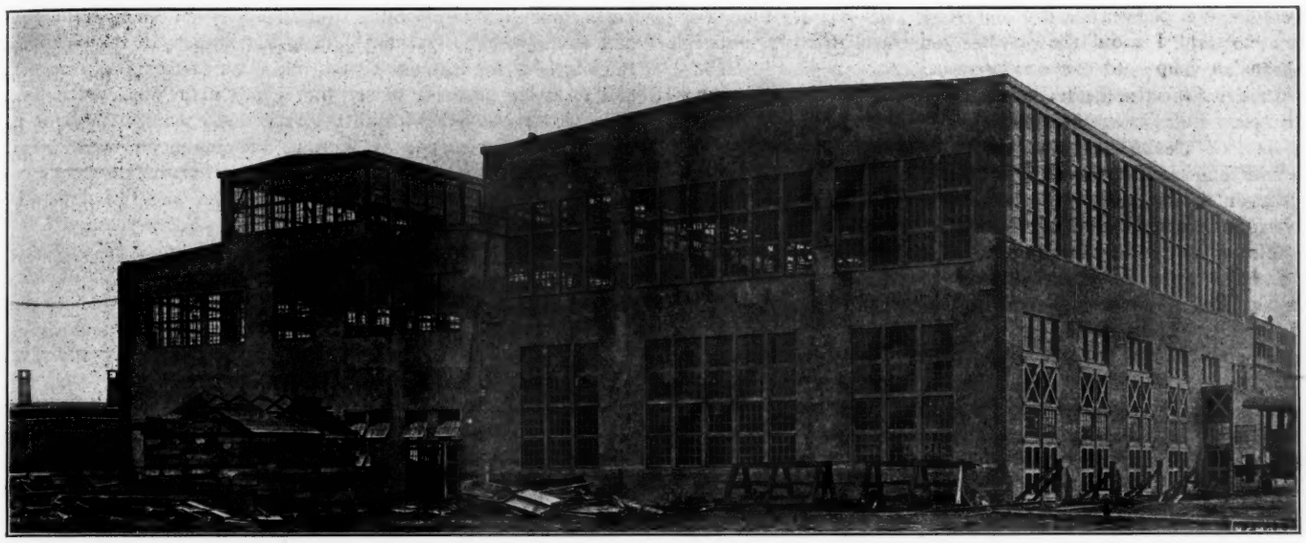
Power House.—The power house is a brick and concrete building 60 ft. x 62 ft., and about 25 ft. high, with steel roof beams. Alongside the boiler room is an elevated coal track, carried on concrete piers, from which coal is dumped into a bin underneath that opens directly onto the firing floor. The coal cars are placed on this unloading track by locomotives over a pile trestle about 85 ft. long with a 5 per cent. inclination. The equipment of the power house consists of three Stirling water-tube boilers of 184 h. p. each, hand fired, and with individual guyed stacks; space remains for an additional boiler. There are two boiler feed pumps and one 900 h. p. feed water heater large enough to provide for the future as well as the present installation. In the engine room are two generating units of 150 k. w. and 75 k. w., respectively, direct connected to Ideal compound engines. Space is provided for an additional engine. The generators are of the Westinghouse 3-wire, 110 and 220 volt direct current type with balancing coils. There is also a 1,000 cu. ft. compound steam, 2-stage, air compressor of the Ingersoll-Rand make. A 4-panel switchboard controls the electrical distribution through the buildings on the three-wire system.



Cross-section Through the Erecting and Machine Shops at Wichita, Kan.; Kansas City, Mexico & Orient.

Oil House.—Between the engine house and the power plant is the oil house. It is also a completely fireproof structure of brick and reinforced concrete. It has a concrete platform with extended storage vault space beneath it and outside of the oil house proper. The basement accommodates oil tanks, mostly of 700 gal. capacity each, for the various oils and lubricants. A Bowser system of self-measuring oil pumps and indicators is provided.

Storehouse.—The next building to the north of the power house is the storehouse. It is a one-story brick building with



Locomotive Shop; Kansas City, Mexico & Orient, Wichita, Kan.

concrete foundations, plank floor and wooden roof construction, the roof being carried on a double row of timber posts. The building is 84 ft. x 49 ft., and is entirely surrounded by a loading platform which is about 6 feet wide on both long sides of the building and so extended lengthwise as to cover an area of about 42 ft. x 62 ft. beyond each end.

Coach and Paint Shop.—This building is so located to the northwest of the locomotive repair shop, that both it and the locomotive repair shop will eventually be served by the same transfer table when future operations may warrant its installation. Like the locomotive shop, only the initial bays of the building are now installed, and the north wall is of timber construction so as to admit of economical extension of the plant whenever required. At present the building consists of three bays each 20 ft. wide with storage space 8 ft. wide across one end, the present outside dimensions being 115 ft. x 74 ft. The building is of simple construction, having brick walls with high windows, and swinging doors in both side walls for three coach tracks which pass through it.

Planing Mill.—Beyond the storehouse and scrap bins is located the planing mill. It is a brick building 94 ft. x 78 ft., one story high, with a single row of timber posts down the center supporting a wide monitor-type roof on wooden trusses. The main windows are about 10 ft. x 16 ft. and four swinging doors are arranged to accommodate two tracks completely through the building. The building is heated by the direct system using exhaust steam from the power house; artificial light is supplied by six type E Cooper-Hewitt lamps. Live steam service is also introduced for heating glue pots. The planing mill is fitted with a number of new tools, among which are a 14 in. x 20 in. timber sizer, a 24 in. pattern maker's lathe, a 4-spindle wood borer, a 6 in. x 14 in. molder, a 2-spindle shaper, a jig saw, combination saw, a 24 in. pony planer, a self-feeding rip saw, and a cabinet mortiser and borer, besides a complete outfit of saw and knife

Interior of Heavy Machine Bay in Locomotive Shop; Kansas City, Mexico & Orient, Wichita, Kan.

grinding machinery, benches and vises. Several old tools from another shop are also used. The tools are belted to two line shafts run by separate direct current motors of 40 and 50 h. p. capacity, respectively, the line shafting being carried on the roof trusses.

Fuel Oil Supply.—At the south end of the locomotive shop in a concrete vault is a tank for fuel oil which is used at the furnaces in the blacksmith and boiler shops, and also in the roundhouse where it is used for lighting fires.

The construction work was begun in May, 1910. The design and construction were carried out by Westinghouse, Church, Kerr & Co. under the direction of E. Dickinson, vice-president and general manager; F. Mertscheimer, general superintendent motive power and car department; W. W. Colpitts, chief engineer, and A. F. Dickinson, superintendent. Master mechanic David Patterson is in charge of the operation of the shop.

AN OBJECT LESSON IN EFFICIENCY.

The Tabor Manufacturing Company has frequently been cited as an illustration of what may be accomplished by introducing efficiency methods in a shop, and the following extract from a paper presented before the Congress of Technology at the fiftieth anniversary of the granting of the charter of the Massachusetts Institute of Technology, by Wilfred Lewis, the president of the company, is thus of special interest.

In 1910 The Tabor Manufacturing Company turned out 2½ times as much value in finished product as it ever did under the old regime with the same force. Formerly for every ten men engaged as producers, or "chipmakers," as Mr. Dodge defines them, we had not more than one man connected with the shop as a non-producer. Now we have fewer men at the machines with three times as many non-producers turning out practically three times as much work, because prices are lower today than they were five or six years ago, and 2½ times the value means about three times the product.

It is not an easy matter to start any innovation in an open shop full of union men, and, as might be anticipated, the appearance of a man with a stop watch and tally sheet was at first strenuously opposed by the workmen. So also was the suggestion of a bonus for the successful performance of an allotted task. But the kickers were gradually converted or discouraged, better discipline was established, and a few of the men were soon earning 30 per cent. more wages than they could command elsewhere. In the beginning the men were suspicious and disinclined to believe that a good performance was not to be the signal for a cut in price, but they have since learned by experience that prices are fixed by the management upon definite knowledge of all the time elements involved in any piece of work and that the time allowed will not be changed so long as the method employed remains the same. In this way the management demonstrates its loyalty to the workmen and they in turn are glad of an opportunity to demonstrate their loyalty to the management, as they did last year.

We pay better wages for fuller and better results performed in a definite way, and yet there is no driving in the ordinary sense of the word. The tasks assigned to the workmen are easily within their ability to perform, and when new work is given out, as occasionally happens, at day rates, before the time on the job has been set, nobody wants to take it because there is no bonus attached for its quick and accurate performance.

But our wonderful increase in production is not due entirely to rapidity of performance, for in some instances very little gain in that direction has been made. A great deal is due to the functional foremen whose duty it is to prepare and guide the way of every piece of work going through the shop. The old notion that a man cannot serve two masters or take orders from more than one superior is denied by the new philosophy which makes it possible for a workman to have as many bosses as there are functions to be performed. There is no conflict of authority unless the functions overlap and even there, such conflict as may arise is salutary and to the interest of the company. A gang boss for instance covers one class of machines or work, and it is his business to see that every man is provided with at least one new job with all the tools and fixtures ready for its immediate performance as soon as the job upon which he is engaged has been completed. He also gives the necessary instructions about setting the work, explains the drawings and teaches the workman how to set his work when necessary. This man has nothing to do with the running of machines and does not interfere at all with the speed boss who also has supervision in his function over the same men as the gang boss and sees that each machine is run at its proper speed with feed and cut as per written instructions. He also teaches the workman and gives him such practical assistance as may be needed.

An inspector also helps the same set of men and sees that the work done is of the right quality and that the first piece made is up to the standard in all dimensions, fit and finish. He also makes further inspection from time to time to see that the standard is maintained. An over-zealous speed boss in his desire for a large output may impair the quality of the work done by exceeding the speed limit and there is therefore the possibility of a conflict between the speed loss and the inspector, but the inspector's requirements must be fulfilled and such a conflict cannot fail to be salutary, because rapidity of production when accompanied by inferior results is never to be desired, and in almost all cases some method is found by which high speed can be maintained and the best quality be preserved. It rarely happens that the superintendent or manager is called on to adjust a difficulty between the two functional foremen.

In the planning department, which is to the shop what the drawing room has been for many years to the superintendent, every new machine is chartered to show the progress of the work through the shop and every piece is provided with an instruction card for its proper manipulation showing the machine upon which it is to be done, the tools and fixtures required, the feeds and speeds to be used, the sequence of operations and the time allowed in detail for each and every elementary movement. As these operations are performed they are checked off in a route file from which can be seen at any time the exact conditions of the work and the time remaining for its completion.

An order of work clerk directs the progress of the orders to be filled in accordance with a schedule prepared by the manager in consultation with the sales department and he has before him in miniature a view of the whole shop, showing every machine or vise, the work being done on each, the work ready to be done and the work ahead in the shop which has not yet arrived at the machine. This is on a large board or wall plate which shows also what machines are manned and where a man can be conveniently shifted when there is no work ahead at his particular machine. By this means all the work in the shop is kept moving in proper balance at a normal rate of speed, men are taken on or laid off as the exigencies of business may require and no loss is sustained by the usual tendency of workmen to relax when, in times like these, orders are falling off and work ahead is hard to find. At such times we are, of course, obliged to curtail production, and the situation being apparent to all, no complaint is made against a reduction in time which we always prefer to a loss of well trained men.

A well equipped tool room in charge of a competent man is a sine-qua-non in any machine shop and here also one of our great improvements has been made. Formerly each workman was inclined to accumulate his own assortment of tools and fixtures which were stowed away in dark corners and kept in disorder and confusion. Now everything comes in perfect order (and the best of its kind) from the tool room as required, and goes back again when the job for which it was taken out is finished. Tools are ground to standard forms and not to suit the whims of individual workmen and the tool room is responsible for the condition of all tools sent out.

The drawing room is perhaps of all departments less affected by the new order of things than any other, and yet there is an indirect effect due to the atmosphere of activity which pervades the whole plant. Here the work is by its very nature more or less original and, of course, no time can be set for the completion of that which is not definitely known, and which grows into shape by a process of trial and error, until something satisfactory is attained. Designing is not therefore amenable to time study, and, depending largely as it does upon inspiration, there is no superior intelligence to direct its progress. It is in the nature of original research which flourishes and bears its best fruit under adverse criticism. A good designer is like a good composer, his work is creative and full of harmonies, and being an artist in his line he cannot be held to a time schedule. In original work, the incentive, therefore, must come from within rather than from without, and this is generally inborn with the ability to create. Copyists on the other hand, who always need direction, might be brought under the domination of time study and in many clerical operations this has been done; but we have not yet attempted to fix tasks in tracing or bookkeeping, and we do not pretend to say that our development is by any means complete. We have progressed, however, to a point which makes further progress comparatively easy, and in the face of stubborn opposition we have firmly established a successful business upon the principles of scientific management as laid down by Dr. Taylor. An application of the same principles to the management of the railways of this country has been estimated as capable of effecting a saving of a million dollars a day. This means increased production and higher wages at a lower labor cost and contains the key to the solution of the labor problem. Labor is made to share in the increased production realized and the reward of labor is made to depend upon the individual effort put forth in production. The Taylor system makes more room on top and gives a better chance to rise. Men thus schooled in efficiency are qualified for better service and learn to measure more accurately the value of time.

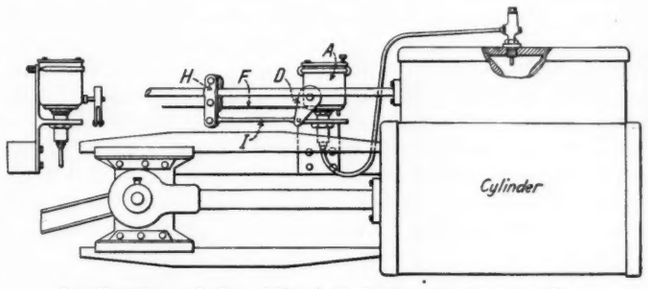
LUBRICATING LOCOMOTIVE VALVES AND CYLINDERS WITH GRAPHITE.

The Long Island has for some time been operating an eight-wheel passenger locomotive equipped with a device for lubricating the valves and cylinders with a mixture of extra fine crystalline graphite and oil. As a result the surfaces soon became coated with a thin film of graphite, reducing the friction between the parts, as compared with the use of oil, and also considerably increasing the number of miles run per pint of lubricant. While no fuel tests have been made, those in charge of the locomotive believe that less coal is required per unit of output. Tests of European locomotives equipped with the same device are said to show a fuel saving of 5 per cent. and upward.

The device, or pump, is automatic in action; is placed near the cylinder, one on each side, as shown on the illustrations; and is operated by a connection with the valve rod. It does not require any attention on the part of the engine crew except for adjustment at the beginning of the run. Nor does it require much attention on the part of the engine house force except for the occasional replacing of a small leather washer. The device is in successful use on a large number of locomotives in Europe; one road having about 900 locomotives has, after a protracted trial, issued instructions for its application to all the locomotives as they pass through the shop.

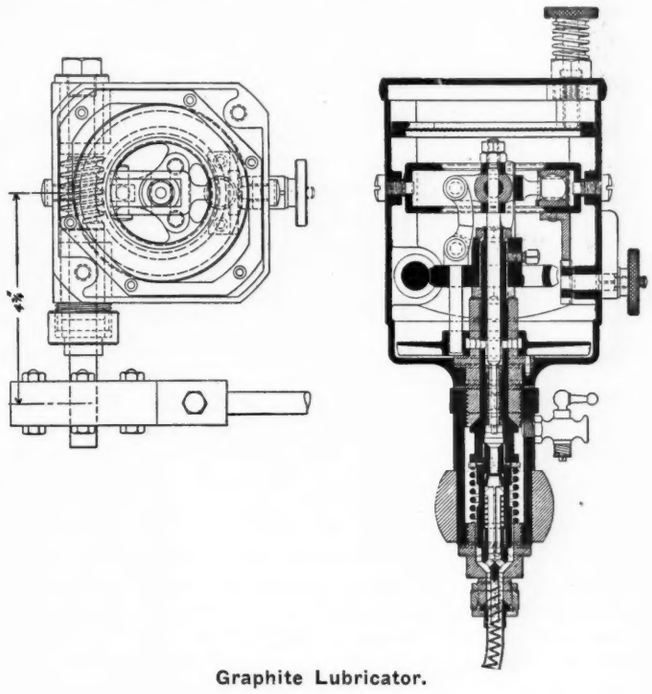
Attempts have been made in the past to use graphite for locomotive cylinder lubrication, but without success because of the difficulty of feeding it to the cylinders properly. The trouble has been to keep the graphite in suspension in oil or other fluids. In the device in use on the Long Island, which is controlled by Knowles & Wollaston of London, Eng., who have established a New York office, this is accomplished by stirring or agitating the mixture continuously until it reaches the steam chest. It does this in the following manner:

The pump, which is enclosed in a brass casing *A*, is securely fastened in place, as shown. The lubricant, to the extent of three pints, is introduced by removing the top of the casing. As indicated on the sectional drawing a fine screen is fitted in the top of the device through which the lubricant must pass. Directly underneath the screen is a circular box-shaped casting supported



Application of Graphite Lubricator to Locomotive.

on two pivots. A short arm projects downward from this casting at the right; at its lower end is a toothed sector which meshes with a small pinion on the end of a shaft that extends through the casing and has a knurled nut at its outer end. By turning this nut the pivoted box casting can be set at an angle with its horizontal position, a pointer on the outside indicating the amount of this angle. With the box in a horizontal position the stroke of the pump is zero. As the box is inclined more and more the stroke is increased. Within the box at the right is a crosshead enclosing a spherical knob which is formed on the



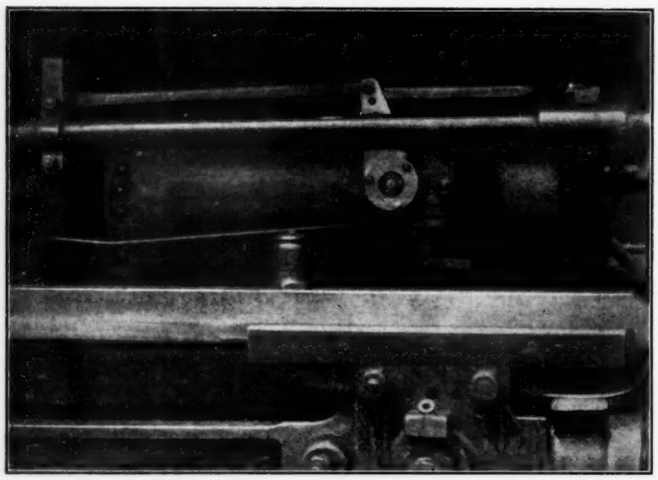
Graphite Lubricator.

end of a forked lever that rotates and rises, according to the inclination at which the box may be set. The forked lever is connected at the other, or left, end to a short link; to the right of this and near the middle of the lever it carries between the forks a truncated sphere, through which the end of the pump ram passes. The pump ram works in a rotating casing to which a worm wheel is attached that is driven by the worm. This worm is driven by the ratchet *D*, through the connecting rod *I*, which is fastened to the clamp *H* on the valve rod.

The pump barrel works within a gland screwed into the bot-

tom of the casing; this gland extends through the casing and carries on its upper side a short cylindrical casing. Within the main casing this gland provides a seat for a two-vaned propeller which stirs up the graphite and oil. Returning to the short curved link, which is attached to the end of the forked lever, it will be seen that it is pivoted from a bolt passing through the worm wheel, and extending down into a hole formed for its reception in the boss of the propeller. The rotation of the worm thus drives the worm wheel, the propeller, the link and forked lever, the pump ram and the pump barrel. In addition, the ram has a rising and falling motion due to the inclination of the guide-box.

Within the lower cylindrical casing the pump barrel, which bears against the lower surface of the fixed gland through an inclined shoulder, has screwed into it a valve casing. This casing is in turn closed by a nipple through which two holes lead to the delivery pipe. A non-return valve provided with a small leather washer at its upper end is held up against its seat in the valve chamber by a spring. The end of the nipple protrudes in the shape of a spigot just within the copper delivery pipe. A spiral spring extends through the delivery pipe from an extension spigot to the point of delivery into the steam chest and is rotated by its attachment to the spigot. The rotation of this spring keeps the lubricant stirred up during its entire passage through the pipe. A strong spring bears against the lower end of the pump casing and takes up wear, preventing leakage from the



Application of Graphite Lubricator to Long Island Locomotive.

upper chamber. This is quite important when the jars and shocks to which the apparatus on the locomotive is subjected is considered. The lubricant finds its way from the reservoir to the interior of the pump barrel through a hole drilled in the boss of the propeller. This admits the mixture to an annular channel formed on the inner surface of the boss. Two ports in the stationary gland then conduct it to a similar channel on the inner surface of the gland, and from this passage it escapes to the interior of the barrel through two other ports drilled through its walls. In this way the lubricant has an uninterrupted access to the barrel at all periods of its revolution. A small hollow piston is carried on the reduced lower end of the ram, and is given 1/32-in. vertical play between a cone seat and a winged nut on the extreme end of the ram. During the up stroke of the ram the lubricant thus has free admission past the conical seat to the under side of the piston; on the down stroke the cone and piston close up so as to pump the mixture past the non-return valve. On the lower cylindrical chamber an air cock is provided for use when starting up.

There can be but very slight wear on the parts because they move slowly and are always flooded with the lubricant. Because of the exposure of the device arrangements have been provided to heat it by steam during cold weather through the pipe *F*.

It must be thoroughly understood that pure crystalline graphite only is suitable for cylinder lubrication. Amorphous graphite contains impurities which are difficult to eradicate and make it entirely unsuitable for the purpose. Even the crystalline graphite must be carefully refined to give successful results.

Compared with practical results from lubrication with oil alone, the new surface conditions of cylinders, valves and pistons continuously maintained by use of the mixture fed by this device, would seem to assure less liability of scoring, a reduction of internal friction, and a corresponding increase in effective horse power without expenditure of additional fuel.

BORING, TURNING AND MOUNTING CAR WHEELS AND AXLES.

BY W. H. MARKLAND,

General Shop Inspector, Altoona Shops, Pennsylvania Railroad.

Boring car wheels, turning axles and mounting the wheels on the axles are questions that for some reason have not received the attention in railway shops that work of a similar character is receiving in other shops. A careful study has been made with the idea of improving the methods, and, incidentally, if possible, reducing the costs. Many experiments and tests were made and a few devices were introduced which may be of interest to the railways generally. Some of the devices that will be mentioned were described in the report of the committee on mounting pressures for various size axles and kinds of wheels, which reported at the Master Car Builders' Convention, 1910.

The majority of axles and wheels machined in railway shops are for repair work, i. e., fitting new wheels to old axles or refinishing cut journals. It must, of course, be recognized that safety is of the utmost importance and that wheels must be fitted to the axles in such a manner as to insure their not working loose in service. However, the question of the cost of work of this nature is also a consideration. The fact that in no case has a wheel been reported loose when mounted by the methods described below, would indicate that the system is entirely safe. Considered as a whole, it is also more economical than most of the previous methods.

In comparing the cost of wheel and axle work, especially repair work, the life of the axle must be considered. As an illustration, the useful life of an axle depends on the size when new and worn, or turned to unsafe limits. For axles used under 100,000 lb. capacity cars, the finish turned parts differ in size about ¼ inch when new and ready for scrap. Careless turning may reduce the diameter an amount equivalent to a long period of service. The ¼ in. difference in diameter between the new and the scrap axle, which constitutes its useful life, may be compared to a tube with a wall ⅛ in. thick. A calculation will show that this metal, considering the new and the scrap value of the axle, is worth about 50 cents per pound, also that each .001 in. in diameter of the tube is worth about 4 cents. Suppose two axles are to be repaired. One is carelessly turned 1/32 in. smaller than the other, and its value is reduced to $1.28 less than the other. While the diameter may not be the cause of scrapping the axle, or one journal may be cut, or the collar worn, removing the smallest amount of metal possible is of the utmost importance. The question of a slight increased cost in machining should be secondary to that of saving the metal.

Dents or marks on the journals often necessitate removing considerable metal. Unless care is exercised when handling mounted wheels, there is a possibility of the flange of one wheel striking the journal of an adjacent axle; also in handling axles with bars there is a possibility of denting and scratching them. A good rule to follow in loading mounted wheels and axles on cars for shipment is never to load different size wheels and axles adjacent to each other without blocking between. This will also apply when they are stored on tracks. If wheels and axles of the same size are placed so that one wheel will strike

the adjacent axle inside of the wheel the journal will not be effected, and if reasonable care is exercised there should be no necessity for placing guards on the journals. Where bars or chains are used for handling finished axles, many dents and scratches may be avoided by covering the bars or chains with o'd air brake hose. A dented journal should call for an investigation.

To properly machine axles and wheels several points must be considered to obtain the best results, such as the speed of turning, centers in axles, lathe centers, turning tools, micrometer calipers, lathe centers in line, boring bars, etc. With any fairly good lathe or mill the work can be well done if the tools are kept in a good state of repair.

The importance of true, properly ground and properly fitting lathe centers cannot be overestimated. No lathe center in any shop should receive more attention, for during their life axles may be turned several times and on different lathes. If the

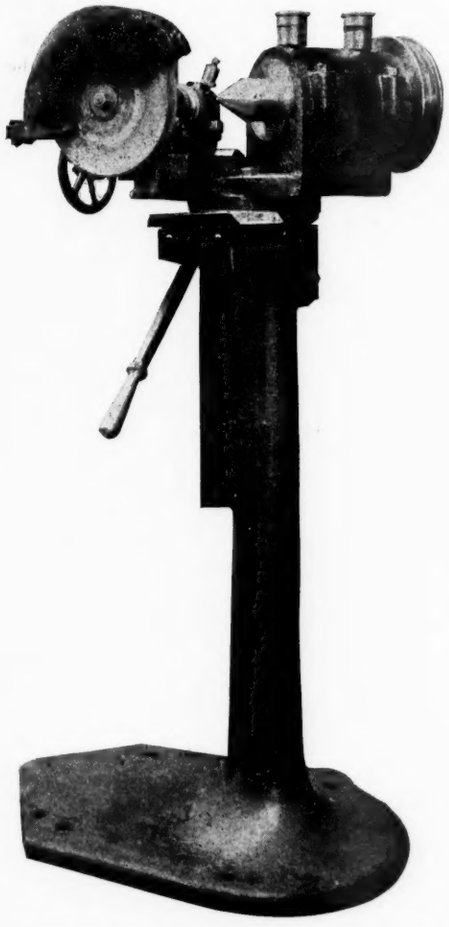


Fig. 1—Machine for Grinding Lathe Centers Accurately.

angle of the centers is not uniform, the center in the axle will be badly and unevenly worn and it will be difficult to do good work. For instance a few axles were found to be turned about .010 in. out of round. Investigation showed that the lathe on which they were turned had centers of about 85 deg., while the axles were centered 60 deg. As a result the axle only rested on the lathe center at the end or it had a line bearing. This line bearing soon wore unevenly, allowing the axle to work back and forth, and was responsible for the eccentricity of the axle. An examination of the centers in axles will often show the results of turning on lathe centers of different angles; the axle centers will have the appearance of having been made with a very badly ground centering tool.

Several of the modern axle lathes have only dead centers and grinding in place is not possible. In many cases they are too large for the average tool room grinder, and as a result the centers are not given the necessary attention. Recognizing the fact that where ready means are provided for grinding centers they will be kept in better condition, the grinding machine shown in Fig. 1 was designed. It will only grind to a 60 deg. included angle, being made thus purposely to prevent possibility of being set wrong. The machine is not expensive and would be a desirable addition to any shop. While the savings due to its use cannot be stated in dollars, there is no question but that the better work will justify its cost. Center gages are cheap and should be frequently tried on centers; if the latter are not the proper shape, or are rough, they should be repaired at once.

Another important point is the necessity of keeping lathes in proper alinement to insure turning a journal or wheel seat the same diameter for its entire length. In some shops a burnisher is used to smooth the journals and a heavy strain is exerted on the lathe that is liable to wear the lathe shears and make frequent repairs necessary to insure satisfactory work. The importance of keeping the lathe in proper alinement can be appreciated when we consider that to mount a steel wheel having a 7 in. bore, or a cast iron wheel of the same size, the axle must be .007 in. and .015 in. approximately larger than the wheel bore; each .001 in. variation will affect the mounting pressure about 10 per cent. If the wheel seat is turned tapered it is not possible to properly caliper it except for the average diameter which will rarely be a true indication for the mounting pressure. If turned tapered, an extra strain may be exerted on one part of the wheel with possibility of no pressure on other parts. Wheels have been removed that only had a bearing for part of their length owing to taper turned axles; while the wheels did not come loose in service, it is a condition which—if known to exist, would be bad for the peace of mind.

By proper care in maintaining lathes this can be avoided. Accurate turning, which will follow, will result in saving in labor when mounting the wheels on the axles. A satisfactory test for lathe alinement is to take two or three light cuts for the entire length of the wheel seat and then measure the diameter with micrometers. There should never be a difference in diameter exceeding .002 in. In every case after repairing lathes to this standard the results have been so much better that the method cannot be too strongly recommended.

Tests made to determine the speed at which axle lathes should be run, developed the fact that 45 r. p. m. was about the limit for car axles, the limit being the chattering of the axle rather than the capacity of the cutting tool, as most any high speed steel will stand this speed with a stream of water flowing on the tool when taking light cuts, such as are generally necessary for repair work. The questions of slow speed and coarse feed, and fast speed and fine feed were also considered. For good work the fast speed and fine feed are more desirable, because of avoiding large humps and hollows. A broad-faced tool fed slowly may look satisfactory. However, there is always a possibility of the workmen not setting the tool nose square, which is liable to result in the wheel having only a few points for bearing. The burnishing wheel or other finish will have to push down or remove the high spots, whereas with fine a feed the humps and hollows will be much smaller. The latter method is decidedly the better. The final cuts should never be taken with a feed less than 16 pitch.

Proper inspection of axles is, of course, important, but to be of value and to keep a shop up to the proper standard, limits should be established. Inspection for diameters cannot well be made with machinists' calipers on account of its being too slow and involving too much of the personal element. Micrometer calipers are more satisfactory for calipering axles as they are generally handled in repair shops. To reduce the time required for making micrometer caliper measurements, the calipers shown in Fig. 2, were designed by the writer. These, in addition to the ordinary micrometer have an arm set at right angles with object to be measured, also the stops *A* that may be turned so that the distance from the top to the center of the axle shall be approxi-

mately the radius of the axle. This admits of quickly setting the caliper in place. One set of stops is approximately correct for 6¾ in. to 7 in. axles, another 6¼ in. to 6½ in. for axles. These stops can be made for any desired diameter within the range of the micrometer screw. In service the caliper is placed over the axle with the arm and the stops *A* resting on the axle. The micrometer is then screwed down until the ratchet clicks, it is then removed and the reading is taken. This caliper obviates all "feeling" for measurement, such as is necessary with the ordinary micrometers and reduces the possibility of error. In practice, six measurements can readily be made and read in one minute. Exact readings to .001 in. can be made and recorded very much quicker than by machinists' calipers. The latter are only of value for mounting wheels when they must be compared or adjusted to calipers previously set to some particular wheel bore.

Fig. 2—Calipers for Car Axle Journals.

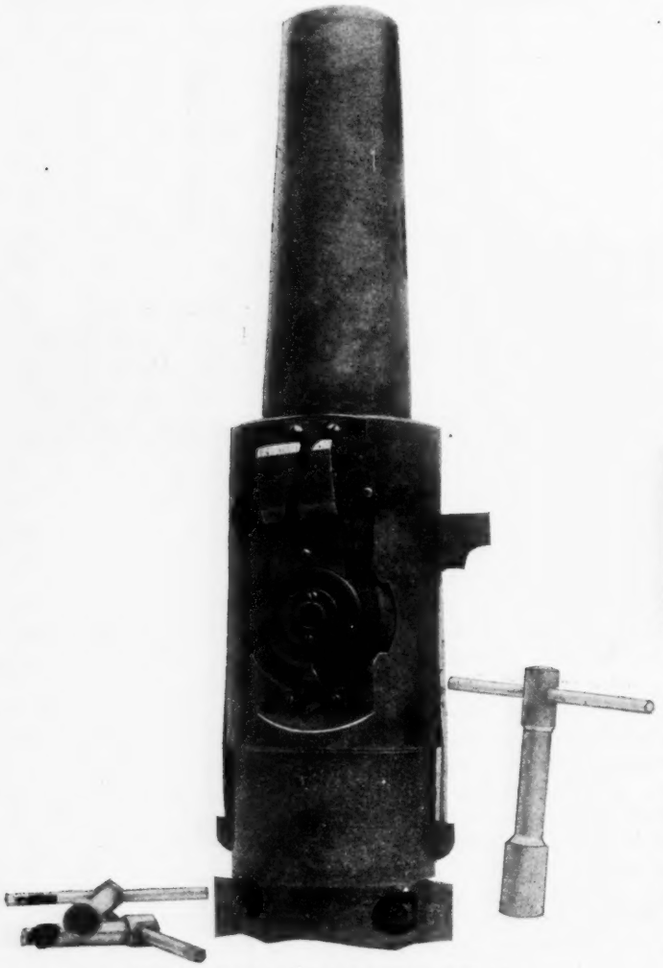


Fig. 3—Boring Bar for Car Wheels.

A method of inspection that has worked out very well in practice is as follows: Each wheel seat is calipered about 1 in. from the dust guard seat, at the middle, and about 1 in. from the other end. These readings to agree within a limit of .003 in., the average size being chalked on the axle for information when mounting the wheels. Should these readings vary more than .003 in., the axle is rejected and re-turned. The journal is inspected in a similar manner, but without recording the sizes. No particular trouble can result from the two ends of the axles not being similar, and any attempt to make them alike will result in many cases, in the removing of unnecessary metal.

By boring wheels to suit the axles the lathe operators do not have use for calipers, as will be explained later, except for the maximum or minimum sizes, which is somewhat novel for lathe work. The question of turning all new axles to one exact size and re-turning repaired axles to snap gages, varying by 1/16 in. or 1/32 in. was carefully considered. A large number of axles that had been turned apparently to uniform sizes were calipered, and showed quite a variation when measured by micrometers—in some cases as much as .010 in. This would be too great for mounting wheels bored to one size. Better work than this is of course possible, but is also expensive.

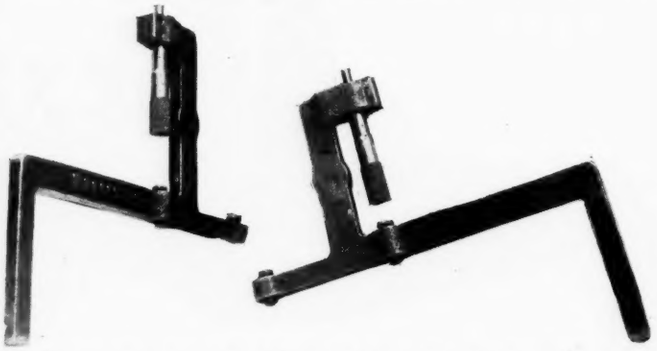


Fig. 4—Special Micrometer Caliper for Boring Wheels.

Investigation developed the fact that with proper boring bars wheels may be bored to varying sizes to suit the axles cheaper than axles can be turned to suit the wheels. To accomplish this called for a boring bar that should be readily adjustable to varying sizes to suit the different axles. It should have a micrometer

adjustment and an index plate that readily indicates the size of the bore in thousandths of an inch; it must be quickly changed from one size to another, and adjustment must be possible to compensate for the wear of the cutters in order to obviate the necessity of grinding them to very accurate measurements. It must have roughing cutters for the first cut and finishing cutters for the finishing or second cut; and all in one boring tool. This necessary refinement for a boring bar is new in some respects for wheel work. Fig. 3, shows a bar that was designed by the writer to meet these requirements. Other bars have also been designed for this purpose, so that there should be no difficulty in obtaining a satisfactory boring bar.

A brief description of the bar shown in Fig. 3 may help to illustrate the points necessary for a satisfactory boring tool. The roughing cutters at the lower end are held by set screws and are only adjustable by loosening these screws. This is satisfactory for large shops boring many wheels to approximately one size. However, for small shops where sizes are changed often, more ready means for adjustment is desirable objectionable, because of the uneven stress on the wheel when mounting, which may start a crack. Because of the eccentricity of the rough bore of steel wheels and the core of cast iron wheels there will always be some motion of the boring bar when boring, even with the most rigid construction. That is, the bar will follow the hole; when the roughing cutters start to go out at the bottom of the hole the bar will vibrate less than when cutting higher up in the hole, which is apt to leave a ridge in the bore. If the finishing cutters are cutting at the same time, they will make a ridge when the roughing cutters go through the hole.

The safe way to bore a wheel is to take a light finishing cut independent of the roughing cut. This is a point well understood in ordinary machine work, but strange to say, for wheel work the scheme of rough and finish boring all at one time is advocated on account of greater output from the machines, while it is true that many wheels are bored very satisfactorily by this plan, the method as a whole is undesirable because of stray wheels going into service having ridges in the bore. Actual trials on cast iron wheels showed that after rough boring it

Fig. 5—Tubular Inside Calipers for Boring Wheels.

The finishing cutters, shown above the roughing cutters, are adjusted by a wrench turning a micrometer screw. On this screw is a dial graduated into 100 divisions, each division equaling .001 in. in diameter in adjusting the finishing cutters. This number of divisions was chosen to allow large spaces between the divisions so that they might be easily read. In case an adjustment of over .100 in. is required, the micrometer screw is turned more than one turn. The index plate is held to the micrometer screw by two screws. By loosening these it can readily be revolved in reference to the micrometer screw. This enables the setting of the index plate to indicate the size of the bore and to compensate for the wear of the cutters. The finishing cutters also have an adjustment by which they may be adjusted true with the bore in the wheel, this being desirable to avoid too close grinding of the cutters, and also on account of the ram of the boring mill and the table not always being in line. One of the finishing cutters may be ground fully 1/16 in. longer than its mate, or the bar may be 1/16 in. out of line, and be compensated for by this adjustment.

Without doubt wheels should be bored with a true hole free from all ridges or roughnesses. Ridges in the wheels are very

was necessary to enlarge the bore .040 in. to insure trueing the bore of all wheels. This with the boring bar and the boring mills in a good state of repair.

To bore wheels to accurate sizes it is desirable to allow a pre-determined amount of work for the finishing cut in order to insure an equal amount of work for the cutters and also a uniform pressure on the various parts that will naturally have more or less give or lost motion. For cast iron wheels the finishing cut can with safety be set at .040 in.; for steel wheels at about .020 in. A practice followed with excellent results with the boring bar shown in Fig. 3, has been to set the roughing cutters to the smallest size bore required in ordinary limits, i. e., when boring wheels from 6⅞ in. to 7 in. they would be set 6⅞ in. As each wheel has rough bores the finishing cutters were set .040 in. less than the size required. The wheel was then bored with both sets of cutters cutting at one time. After this cut was completed the bar was raised and the finishing cutters were set out to the required size and the second cut was taken with the finishing cutters only cutting. As an illustration of the accuracy that may be attained, wheels were called for bored to the following diameters: 6.982, 6.842, 6.928, 6.922, 6.940,

6.848, 6.809, 6.810, 6.822 and 6.796 in. All the wheels were bored in the order called for within a limit of .001 in. No caliper readings were taken except to prove sizes after the wheels were removed from the mill. All changes in sizes were accomplishd by turning the index wheel to the size called for. The boring was done as fast as the cutting tools would permit.

With a satisfactory boring bar, having an accurate micrometer adjustment for the finishing cutters, wheels may be bored to any size required to an accuracy of .001 in. and as many wheels can be turned out as by any other method. Because of the accurate wheel boring, which is an accomplished fact, it is certainly advisable to bore the wheels to suit the axles on account of less cost for labor and removing the smallest possible amount from the axles.

A satisfactory manner of setting the finishing cutters is as follows: A trial cut is taken and calipered with micrometer calipers; the index can then be set to the size shown by the micrometer readings. Fig. 4 illustrates a special micrometer caliper that was designed by the writer for wheel bores. The principal novelty is in the extra arm to insure the caliper being set square with the center line of the wheel. Fig. 5 shows an application of a tubular inside micrometer caliper for same purpose. Readings may readily be made by either of these calipers and the size chalked on the wheel in 30 seconds. With these calipers a satisfactory test for the wheel bore is that it shall not be over .001 in. taper or out of round. This can be lived up to with fairly good tools. The bore should also be smooth and the finishing cut be taken with a feed of tool of at least 4 per inch.

The question of mating wheels to axles to obtain the proper mounting pressure has always been and will continue to be a problem. Many theories were investigated which appeared to have a bearing on the subject, one of them being that the hardness of the wheel had everything to do with the mounting pressure. There may have been some truth in this, but the writer was unable to find it from the advice of men several years in the business. Wheels made from the same run of metal will generally mount at about the same pressure when having the same draw, provided other conditions are similar. There are a number of conditions that will affect the mounting pressure even if the apparent draw is similar. One is the kind of lubricant employed. A test with cast iron wheels showed that the mounting pressure would average about five tons higher using plain oil than with white lead and oil. The turning and calipering of the axle has some influence. If a tool is used that throws up a slight burr or fin, the calipers will read the top of this and not to the solid metal, which is liable to cause mounting at low pressure. The trouble of wheel or axle galling cannot in all cases be guarded against and may cause considerable variation in the pressure, especially on steel wheels.

For accurate mounting of the wheels to a uniform pressure, no method of measurements and inspection has been devised to equal the micrometer method, and with the calipers described above, where the readings can be made quickly with but few possibilities of error, there should be no reason to continue the use of machinists' calipers. While it is true that an expert can caliper very satisfactorily with machinists' calipers, there will always be a personal element or equation that will not exist with the micrometer described. One result will generally follow where micrometers are used and a careful inspection is insisted on. The wheel seat will be turned fairly true. With these conditions and the draw, or the mounting pressure, carefully checked the wheel will have ample bearing on the axle and will not work loose.

A large number of measurements were taken to determine the proper draw or the amount the axle should be made larger than the wheel. No general rule can be given for it, because of wheels from various mills and foundries differing. However, by measuring the draw with the micrometer and noting the mounting pressure on a few wheels, the proper draw for any lot of wheels can be arrived at that will be a fairly true indication of the proper mounting pressure.

A plan for mounting wheels on axles that has worked very satisfactorily is as follows: Each axle when turned is calipered and the size of the wheel seat is chalked on it near the wheel seat. From these sizes a list is made for the boring mill operator, deducting the necessary amount to be allowed for draw. The wheels are then bored and the size is chalked on the wheel, after being proved by micrometers. The wheels and axles are then mounted, the sizes chalked, giving the neecssary information as to which should go together. This plan avoids hunting among a lot of wheels and axles to find mated pairs and also results in a minimum amount of calipering.

The micrometers which are illustrated have Brown & Sharpe micrometer heads, the frame having been made special. To the best of the writer's knowledge it has never been patented. The tubular inside micrometer caliper, Fig. 5, was made by Brown & Sharpe

Recording gages on mounting presses cannot be too strongly recommended; they are a check by which the superintendent can easily detect any bad or careless work. However, a recording gage is not always a true indication of the mounting pressure, because of the throw of the needle at each impulse of the pump or press. This is more noticeable with pumps having only one ram or piston. For accurate work, the average throw of the needle should be considered.

The question of grinding repaired axles in place of turning is worthy of consideration. At first thought it may not appear inviting, because of the apparent greater cost of the machinery and the possibility of costing more for labor than turning; however, considering other phases the question looks promising. Its advantages will be that a wheel seat once ground will not be injured enough in mounting and dismounting the wheel to require re-grinding each time, unless the wheel galls or scores the axle. That is, when compared to turning, the surface will be smoother and not have tool marks that generally push off when mounting the wheel. From experience with journals used in other machinery, we have every reason to believe that car journals would be ground better than the average of lathe turning and burnishing or filing. The sides of the collars and fillets are difficult to grind properly. The makers of grinding machinery, however, say this is not a hard problem. By grinding, the probabilities are that less metal will be cut away than by any turning method on repaired axles. This should prolong their life. When re-turning there is always a possibility of the workmen cutting deeper than absolutely necessary, in order to get below the glazed surface and insure the removal of all low spots. With grinding, there will be no incentive to cut deeper than absolutely necessary. Actual tests appear to indicate that by grinding only one-half as much metal will be removed as compared to turning; that is, where an axle may be reduced some .30 in. by turning, a similar axle will only be reduced .015 in. by grinding. As explained above, each .001 in. diameter costs about four cents, at which rate the value of the axle would be reduced 60 cents more by re-turning than by grinding.

LARGE TESTING MACHINE AT BUREAU OF STANDARDS.

A large 2,300,000 lb. Emery testing machine is now being erected at the Washington laboratory of the Bureau of Standards and some of the largest pieces have recently been put in place. These were manufacturd at the works of the Fore River Shipbuilding Company, of Quincy, Mass. The straining press, piston and cylinder head were assembled and forwarded in one piece, the shipping weight being 22½ tons. It was carried across the city on a heavy four-wheel truck drawn by 26 horses, and at the grade on Massachusetts avenue the number was increased to 30. The machine is being installed in the engineering building,

one of the new structures recently erected for the Bureau of Standards.

Some of the important dimensions of the machine are as follows: The main straining press has a diameter of 32 in. Its piston has a stem 22 in. in diameter, and a stroke of 60 in. The two screws connecting the power and the scale ends are 12 in. in diameter by 49 ft. 8 in. long, 30 ft. 8 in. of each being threaded. The pitch of the thread is 1½ in. and the depth ⅝ in. The finished weight of these screws is about 17,800 lbs. each. In the design of the machine one screw is located directly over the other, their axes being horizontal. This arrangement gives convenient access to all parts of the material under test, introducing a feature of great practical value. The center line of the machine is 44 in. above the laboratory floor. Hydraulic power will be used for operating the machines. A central power plant of three accumulators is being installed. The dead weights used aggregate about 200,000 lbs. Two 10-ton traveling cranes form a part of the equipment of the large machine and a 2-ton crane is provided for the smaller one.

SHOP KINKS; LAKE SHORE & MICHIGAN SOUTHERN.

BY A. G. PANCOST.

Draftsman, Elkhart, Ind.

DRIVING WHEEL TIRE CART.

Driving wheel tires are not only difficult to move about an erecting shop or engine house by hand, but often cause more or less serious accidents when handled in that way. A simple and convenient cart for handling these tires safely is shown in Fig. 1. While the tire is held in an upright position the cart is

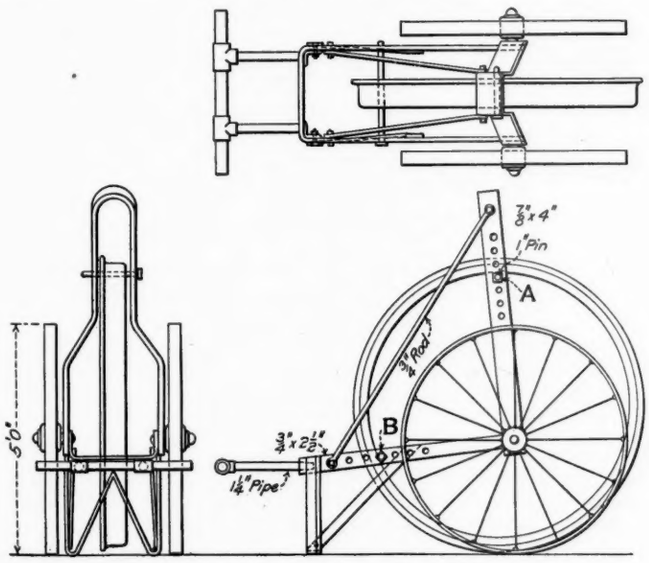


Fig. 1—Cart for Transporting Driving Wheel Tires.

pushed over it and the handle is lifted, thus lowering the upper part of the frame, and a bolt is placed under the tire at A. The handle is then lowered, lifting the tire from the floor and swinging it backward toward the handle. A second bolt B is then passed through the frame inside of the tire, which keeps it from swinging back and forth as it is being moved about.

PORTABLE GASOLINE HEATER.

A convenient portable gasoline heater is shown in Fig. 2. It consists of a 50 or 60-gal. tank, supported on a platform of ½ in. steel, 30 in. wide, and mounted on two pairs of wheels, the front pair being arranged to swivel so that the truck may easily be turned. The vaporized gasoline passes through the piece of ¼-in. pipe, 8 ft. long, into the burner, which is made by drilling several small holes in the side of a brass T and plugging the ends. The hose from the air line and the hose to the burner are each about 30 ft. long. The tank may easily be transported

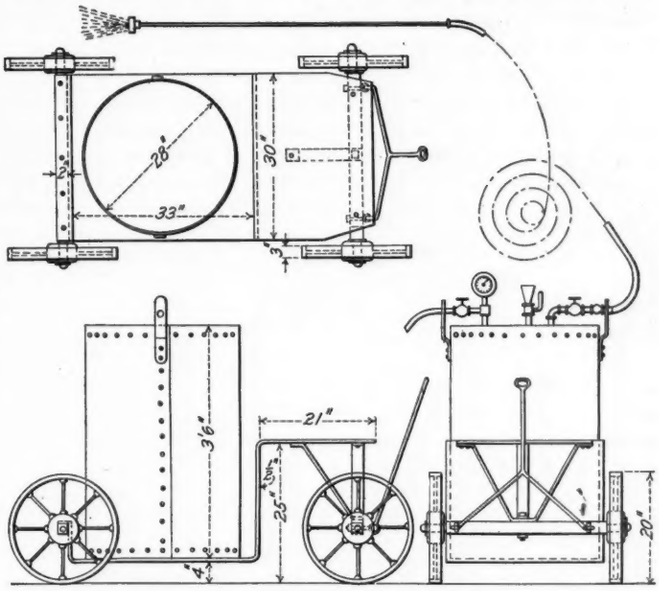


Fig. 2—Portable Gasoline Heater.

about the shop or be taken outside of the building for refilling when necessary.

PORTABLE LAMP STANDARD.

The patience of the workman is often tried when working underneath an engine or in a poorly lighted part of the shop with only an electric bulb attached to an extension cord, and no means of holding or adjusting it to get the light just where it is most needed. The upright or standard shown in Fig. 3 consists of a rod or pipe set in a cast iron base. Near the top of this rod a wrought iron strap is riveted fast, as shown. The two ends of the strap clamp the vertical adjusting rod by means

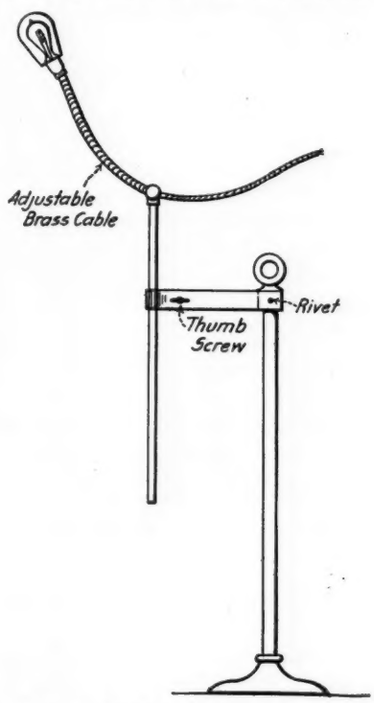


Fig. 3—Portable Lamp Standard.

of the thumb screw. The ball at the top of the adjusting rod, through which the electric wires pass, is connected to a flexible

or adjustable brass cable through which the wires go to the lamp. The lamp may be equipped with a reflector for intensifying the light and directing it where needed. One of these furnished to every repair pit would prove a great convenience.

WATER SHIELD ON TENDER.

Where track troughs are used, trouble often occurs on fast trains because of the breaking of the air hose connections at the rear of the tender, due to the force of the surplus water which does not enter the scoop but passes by and strikes the hose. In the winter much inconvenience and delay is often caused to trains

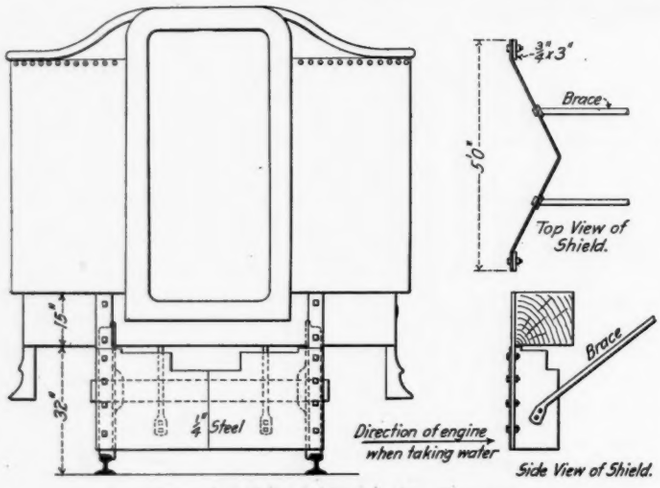


Fig. 4—Water Shield On Tender.

at terminals because of this surplus water freezing around the steam and air connections, making it necessary to use picks or hammers to break the ice away before the engine can be uncoupled. To overcome this difficulty, a sheet steel shield may be suspended from the rear of the tender and directly in front of these connections, as shown in detail in Fig. 4.

SETTING WALSCHAERT VALVE GEAR.

First measure the valves, valve seats and combination levers and see that they agree with the drawings. Place the main wheels on rollers and adjust the main rod to equalize the travel of the crosshead between the striking points. Assemble the parts of the valve gear, using temporary adjustable union links. Find the exact front and back dead centers of the main crank pin in the usual manner and mark them on the wheel with a tram from the frames. Mark the guides showing the travel of the crosshead. Place the engine on one dead center and with a convenient tram mark the guides, or some other stationary part, from the center of the front pin of the eccentric rod, as indicated by a

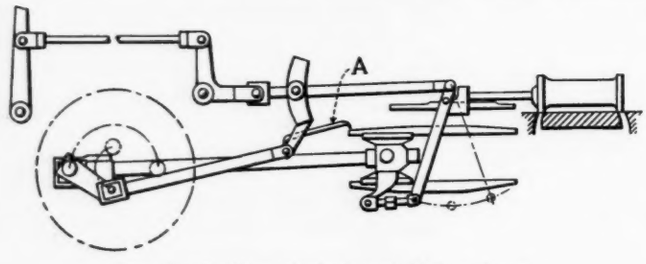


Fig. 5—Setting Walschaert Valve Gear.

tram A in Fig. 5; move the engine to the other center and repeat this operation. These marks should coincide; if they do not, move the eccentric crank on the main pin, so that the front end of the eccentric rod will move a distance equal to one-half the difference between the two marks. Try again and repeat until correct. To save time, the operations for finding the dead centers and the correct positions of the eccentric cranks may be performed at the same time. If it is found necessary to move an eccentric crank, it is advisable to use a temporary fastening and make it permanent after the valves are set.

Place the engine on either center and move the reverse lever to the extreme backward and forward positions, using a tram, as shown by B in Fig. 6, to mark the distance from the center of the front pin in the radius arm to a fixed point on the engine. If these two marks do not coincide, the eccentric must be adjusted an amount equal to half the distance between the tram marks, multiplied by the ratio of the link arm radius to that of the link block.

Disconnect the front end of the eccentric rod and place the link block in the exact center of the link. This point can be found by oscillating the link while placing the reverse lever in

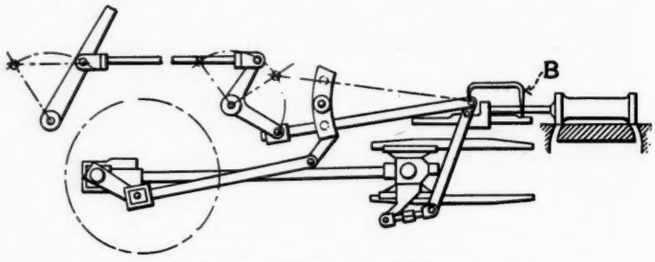


Fig. 6—Setting Walschaert Valve Gear.

different positions until a point is found where no motion is transmitted to the combination lever. The link blocks on both sides of the engine must be in the center of the links with the same position of the reverse lever; if not, adjustment must be made in the lifting device to bring this about. Get the port marks on the valve stem or other convenient part in the usual manner, showing the opening of the steam and the exhaust edges of the valves; also mark the point half way between these two marks.

Place the crosshead in the middle of its travel, and with straight

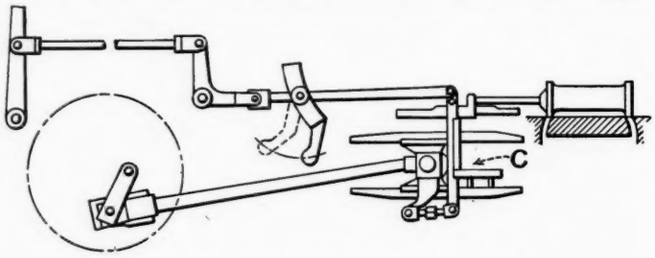


Fig. 7—Setting Walschaert Valve Gear.

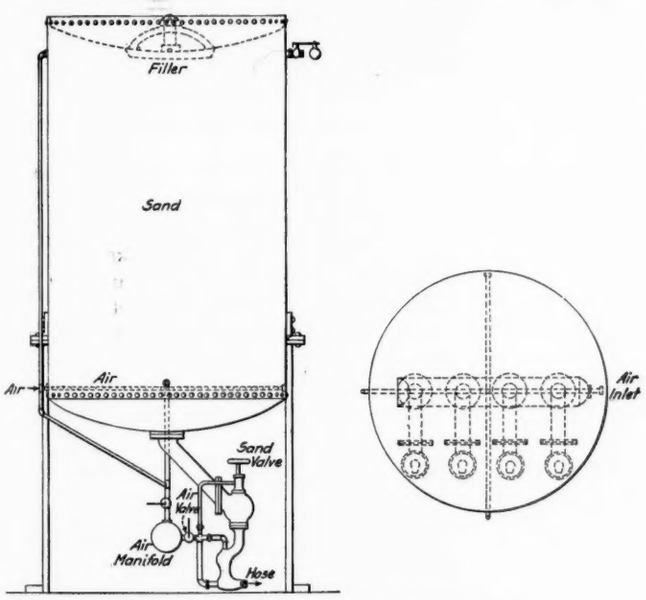
edges on the lower guides and a square, as shown at C, Fig. 7, adjust the temporary union link until a straight line through the center of the upper two holes in the combination lever is square with the guides. Tram the position of the valve; if it is not central with the ports, adjust the valve stem to make it so and move the port marks accordingly. To save time, only the port marks need be changed at this time and the valve stem can be adjusted later.

The valves should now be run over to find the different valve events. The lead should be equal at both ends and the same for all positions of the reverse lever. The port opening may be found to be greater at one end than at the other, causing the other events to be unequal; if so, adjust the union link to make the different events alike at both ends, or nearly so; this should not affect the lead to any extent. The valves may be considered correctly set when the cut off and the release in the forward gear at 25 per cent. cut off do not vary more than 1 in. between the extreme of the four positions; the temporary adjustments should now be made permanent. The three sketches, Figs. 5, 6 and 7, should be placed in the hands of all workmen interested in the setting of Walschaert valve gear, or where the workmen may easily refer to them.

SAND BLAST APPARATUS.

It is often desirable to use two or more sand blast nozzles at the same time, when cleaning steel cars and tenders for repainting and other purposes. These may be taken from individual sand tanks, or two or more nozzles may be supplied from a single outlet on one tank, the current of air and sand being subdivided by Y fittings. These methods are open to objections, because of the time required to refill the individual tanks, and, when Y's are used, the stopping of one nozzle means stopping the other as well, or of re-adjusting the flow of sand. To overcome these objections and provide a sand blast of large capacity, the Drucklieb multiple injector sand blast apparatus has been designed. It consists of a vertical cylindrical tank of boiler steel, with a concave head and a convex bottom, supported on substantial steel channel legs.

The tank is filled through a large inlet in the top, which is closed by a heavy cap that can be quickly removed and replaced.



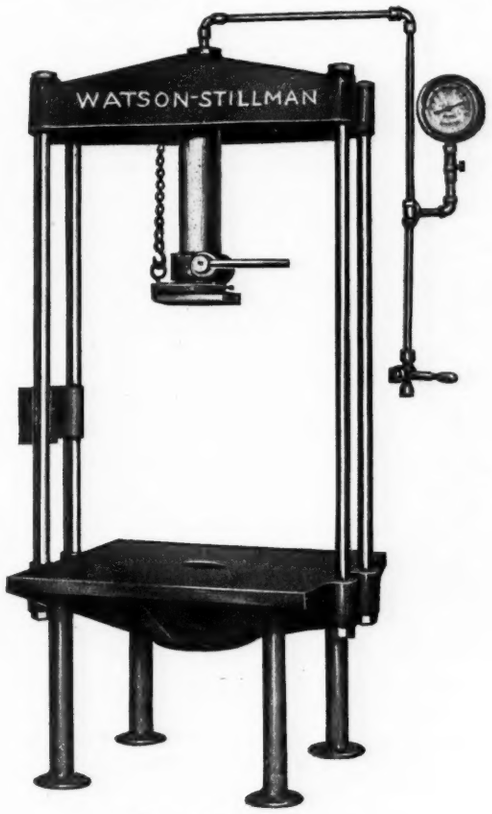
Multiple Injector Sand Blast Apparatus.

The tanks are made to hold 2,000, 4,000, 6,000 and 16,000 lbs. of sand, with one, two, three or four flanged outlets, as desired, riveted to the bottom. To these outlets are attached special sand pipes leading the sand by gravity by the Drucklieb injector sand blast apparatus, its flow being started, regulated and stopped by a special sand valve, so constructed that the pressure or crowding of the sand into the valve chamber cannot clog it. This valve has a central downward air jet, which causes the sand to flow evenly and regularly through the annular space between the valve and its seat. Below the sand valve chamber is a Drucklieb mixing chamber, in which the flowing sand is further mixed with air admitted through the mixing and forcing apertures, the full mixing being effected before the mixture reaches the delivery hose.

Compressed air is piped into a horizontal riveted steel manifold or air receiver placed below the sand tank; connections to each outlet are made to the three inlets of each mixing chamber, all being controlled by one lever handle, quick opening gate valve. A connection is also made from the manifold to the uper and lower part of the sand tank to balance the pressure therein, and insure the free flow of the sand. The manifold also acts as an air separator, and means are provided for carrying off any moisture. Each outlet has the usual complement of rubber hose, nozzle holder and steel nozzles. The several nozzles may be started together or one at a time, and may be regulated and stopped at will, without interfering with one another. The sand is regulated by the sand valve and the air by the gate valve, both of which are near the ground and convenient to the operator. The sand outlets may be located to suit conditions, but are usually in line, facing in one direction. They can, however, be made to face to any point of the circumference of the sand tank and may be attached to a closed tank of any required capacity from which the sand will flow. The capacity of the tank is large enough to insure a long period of operation without refilling; the regulation is close and economical, and the several sand blast jets are sharp and effective. The Drucklieb multiple injector sand blast is made and sold by J. M. Betton, 178 Washington street, New York, who a year ago assumed the sand blast business, established by C. Drucklieb in 1905.

HYDRAULIC PRESS.

The hydraulic press shown in the accompanying illustration is especially adapted for pressing in bearings and bushings, and for general machine shop work; it is made by the Watson-Stillman Company, New York. The platens are approximately 3 ft. square and 5 ft. apart, but these dimensions may be varied to suit requirements. A hole through the platen permits bearings or bushings to be forced out when desired. The weight shown at the left is a counterbalance for the ram which may be handled independently of the pump by means of a rack and pinion operated



30-Ton Hydraulic Press.

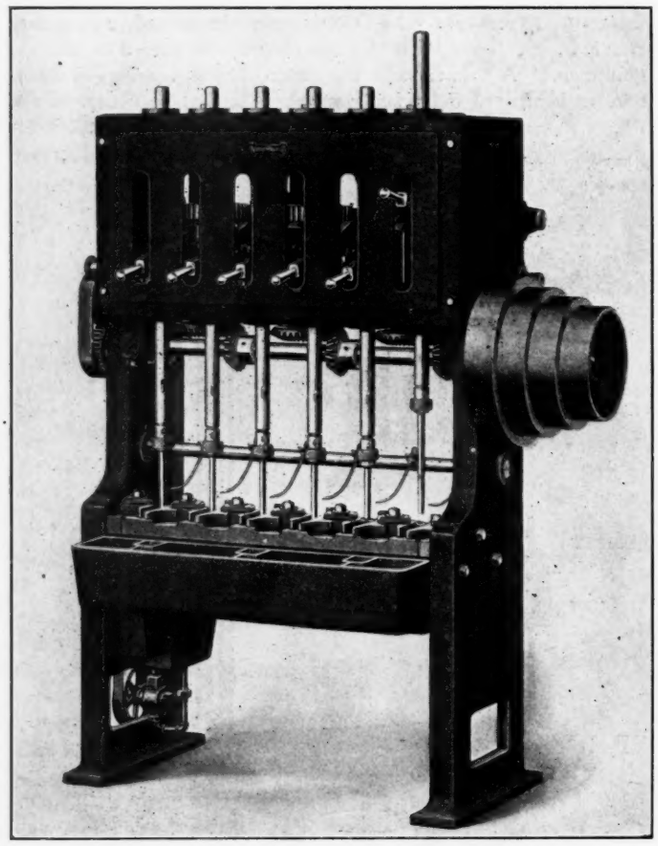
by a lever. This arrangement allows rapid manipulation of the press in adjusting it to the work.

The capacity of the press reaches its maximum of 30 tons under a hydraulic pressure of 6,250 lbs. per square inch, which may be produced by using either a hand or belt-driven pump attached to the pipe. The length of stroke of the ram is 18 in., and its diameter is 3½ in. The long stroke increases its range of the work and is the special feature of the press. The illustration gives the impression that the press is light for its capacity, but the platens are strongly ribbed and a high grade of material is used throughout. The press is supported from the floor by four legs, thus making it more convenient to work on.

SEMI-AUTOMATIC NUT TAPPING MACHINE.

A new design of a semi-automatic nut tapping machine, as shown in the accompanying illustration, is being made by the National Machinery Company, Tiffin, Ohio. Rough hot pressed nuts are tapped as readily as cold punched nuts, and the objections to the entirely automatic tapper, due to sticking, etc., are overcome. The spindles are raised and lowered automatically, and the operator, not having to manipulate a foot lever can increase the output from 60 to 80 per cent. above that of the ordinary foot lever machine. The number of revolutions of the tap spindles per raising and lowering may be varied to correspond to the number of threads on the tap. This eliminates the considerable amount of time which is lost by the tap running idle in the nut after it is tapped.

The variations in the revolutions of the tap spindles are secured through a single lever operating quick change speeds on the cam shaft. The raising and lowering of the tap spindles is accomplished by six three-step cams carried on a horizontal shaft in the rear of the spindle housing. These cams engage with hardened steel rolls carried in the spindle lever. The cam shaft shifts laterally so that the various cam shaft faces or steps may be engaged, and in this way the time the tap remains raised may be altered to meet the needs of the operator feeding the machine.

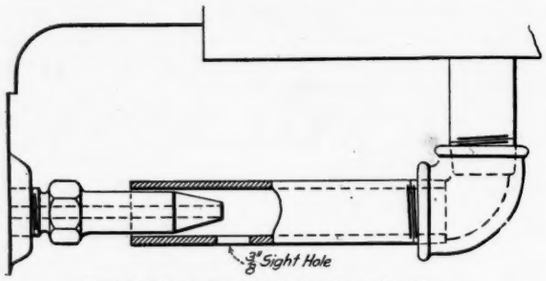


Semi-Automatic Nut Tapping Machine.

The life of the tap is somewhat longer than is generally the case with the foot lever taps, as the cam movement causes the tap to be lowered gradually and does not drop it into the hole with the weight of the spindle back of it, which causes broken taps and stripped threads. An automatic socket is provided which allows the tap to be removed or inserted while the machine is running and ejects the tap automatically when the shank becomes filled with tapped nuts. The machine is built with six spindles for 1 in. nuts, and with 10 spindles for 1½-in. nuts.

VERTICAL TURRET LATHE.

A vertical turret lathe which presents a practical solution of the problems in heavy lathe work has recently been placed on the market by the Bullard Machine Tool Company, Bridgeport, Conn. At first glance the machine has the appearance of a vertical boring mill, but, on closer inspection, the peculiar characteristics will be noted which give it the name of a vertical turret lathe; for although it may perform a certain number of boring-mill operations its chief service is that of a heavy duty lathe. The fact of its dual service gives the machine shown herewith the classification of the Maxi-Mill type.



Sight Feed for Lubrication System.

The vertical turret lathe was designed to meet the present and future demands for a machine of power, rigidity, continued accuracy, convenience of operation, safety of operator and low cost of maintenance. It is readily seen from the construction of the machine that all of the points have been comprehensively considered. The rigidity is apparent from the size of its body and the substantial construction of the carriage ways for both the cross and vertical heads, which have wide as well as long bearings, assuring permanency of alinement; its continued accuracy is a matter of its component parts which are carefully designed with this in view; the convenience of operation is only too evident when the labor of adjusting heavy work on the ordinary lathe is considered; the safety of the operator is provided by the arrangement of the controlling levers and feed adjustments at the side of the machine away from the rotating work and also by the way in which the work is held; it rests directly on the table, thus eliminating the danger of falling out of the

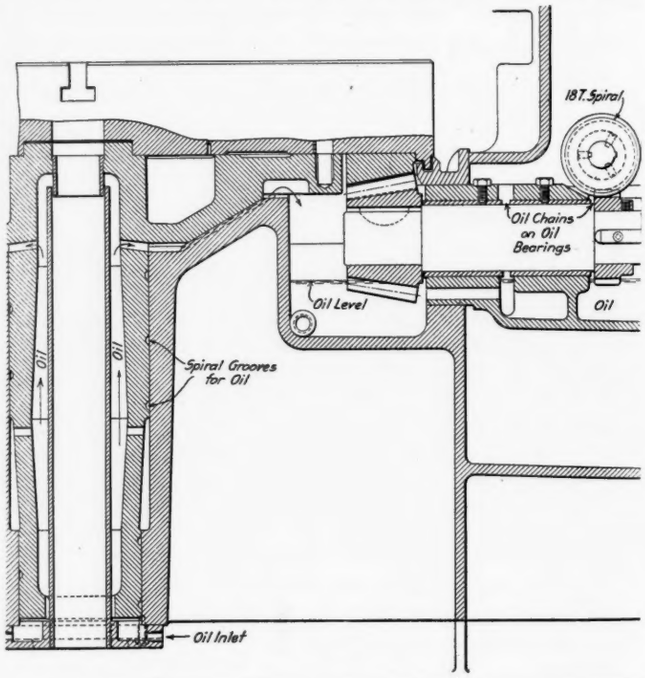
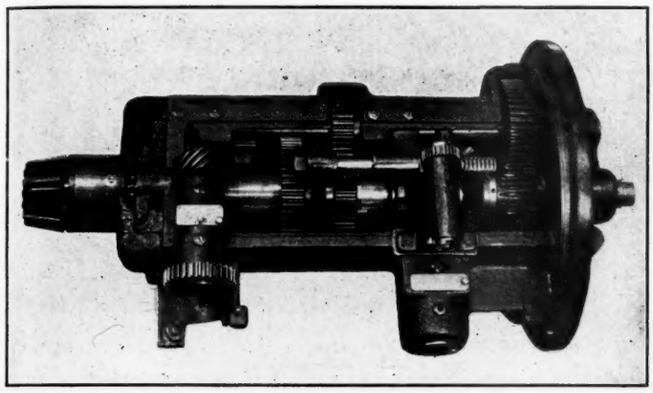


Table Spindle Showing System of Lubrication.

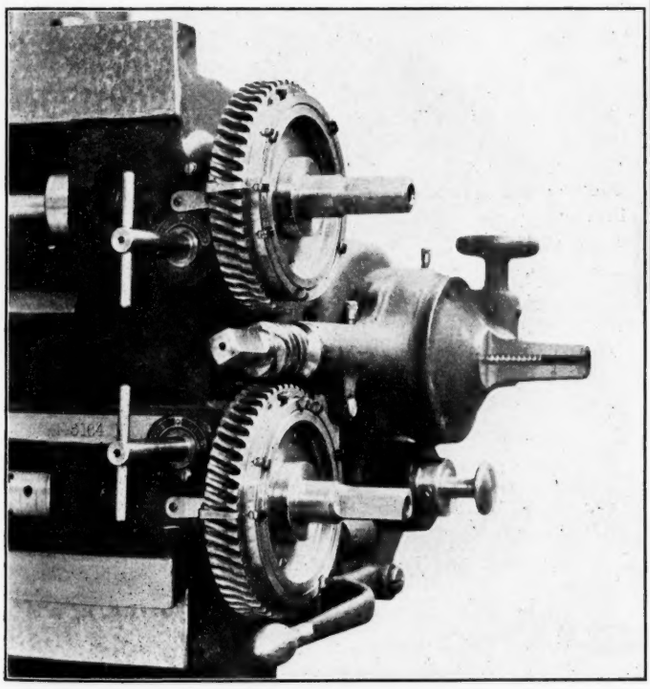
machine, as sometimes happens where the work is clamped to the face plate of the horizontal lathe.

The special features in the construction of the machine are in the speed control, the turret and the system of lubrication. The clutch and brake are both operated by the lever *E*, which engages one after disengaging the other. Any one of four pri-



Sliding Gears for Speed Changes.

mary speeds may be selectively engaged by means of another lever *F*, and secondary speeds are obtained by the lever *G*. The controling levers are positively interlocked in the casing *H*, and the clutch must be released and the brake engaged before a speed change can be made. Likewise, a complete engagement of the gears for any speed is necessary before the brake can be released and the clutch re-engaged. This interlocking provides a safe guard against breakage, due to careless handling, and does not materially interfere with the rapid change of speeds. The operating levers and handles are in a position convenient to the operator, which is conducive to a greater output. The turret on the machine illustrated is 16 in. in diameter; it has five faces

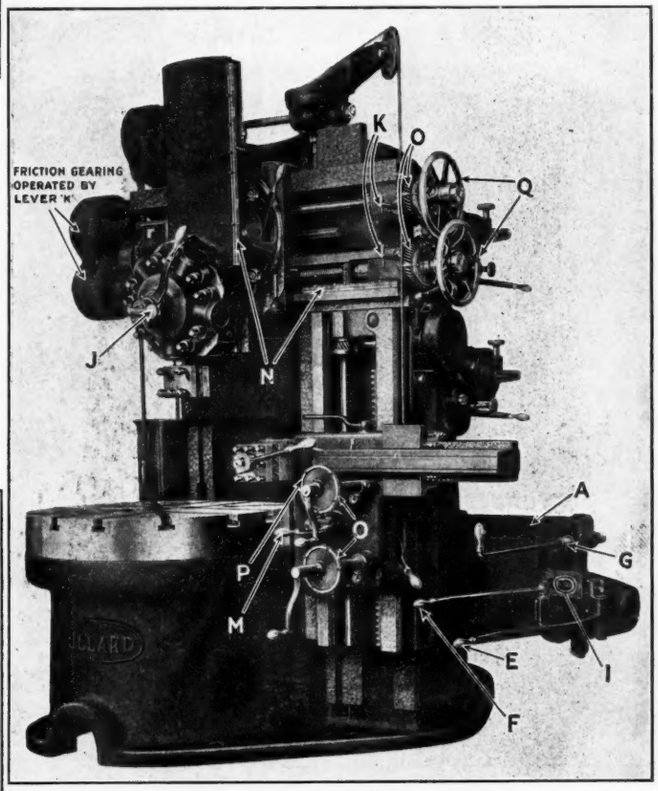


Feed Gears with Micrometer Dials and Observation Stops.

with tool holes 2¾ in. in diameter, in which are placed split steel bushings. Half-boxes, secured to the turret by two binder bolts, bear on the split steel bushings and securely hold the tool shanks. However, as no frictional binder is sufficient to resist the twisting of the tool under a heavy cut, a pin of large diameter is located at the inner end of the turret holes, which fits in a slot in the end of the tool and acts as its driver.

The lubrication is accomplished by means of a continuous flow system starting from the reservoir *R*, located at such a height as to insure sufficient head for the free flow of oil. The system has been carefully arranged, and it is claimed that the power efficiency is materially increased through the reduction of frictional loss in the gears and bearings, that the cost of maintenance is thereby decreased; that the productive time is increased since the oiling is automatically performed, and that the chances of burning bearings are greatly reduced.

The base of the machine forms an oil reservoir to which all of the oil is returned after passing through the various bearings and gear boxes. A submerged pump, geared to the main driving shaft, delivers the oil back to the reservoir, the excess oil being returned back to the base. The oil sights in the ducts are unique in that the free flow of oil is clearly indicated in two ways—by the size of the oil column passing the opening, shown in

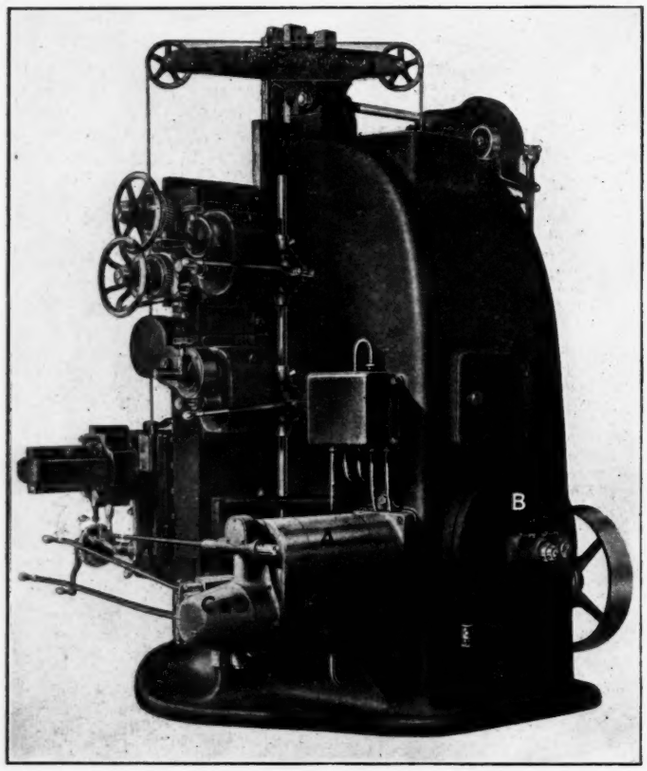


Maxi-Mill Type Vertical Lathe.

the sketch, if the pipe is clear, and by the overflowing at the opening if the pipe becomes plugged. The sketch of the table spindle and driving gears clearly shows the arrangement of the oiling system in those parts. The flow of oil to the bearings is regulated to .02 quarts per square inch per minute.

The machine illustrated will take work 44 in. in diameter and 32 in. in height under the cross-rail, the maximum distance from the table to the turret face being 43 in. The base and column are cast integral and are of box construction, internally braced. The table is 40½ in. in diameter and has parallel T-slots, as well as the ordinary radial slots. The table spindle is of the standard Bullard type, having an angular thrust bearing of large diameter. It is driven by bevel gears of special tooth form which have proved to be superior to the spur drive, giving smooth cuts and eliminating the chattering caused by the poor meshing of spur gear teeth. With the main driving pulley running at 360 r. p. m., the following 12 speeds are mechanically obtained: 3.1, 4, 5.5, 7.1, 11, 16, 20, 27, 34, 46 and 60 r. p. m. The number of table revolutions per minute may be read from the direct reading indicator, *I*, attached to the interlocking device.

The cross-rail has an exceptional width of face and bears on the full width of the column face. The side-rail has the form of an inverted L and is fastened to the column and bed by five binding bolts, so located as to give the greatest rigidity. Both the cross and side-rails form a unit having a vertical adjustment, by power, of 14 in. There is one head on each rail and the heads are independent of each other as regards the direction and amount of feed, being operated joinly on work of small diameter without interference. An absolutely accurate center stop is provided for the main head, which is so designed that it may be carried beyond the center 3 in. The swivel base of the main head has a diameter equal to the full width of saddle, and is secured by numerous binding bolts, which obviate the usual weakness of these parts. An angular adjustment up to 45 deg. on either side of the vertical is obtained by a sytsem of gearing. The turret slide has an exceptionally broad bearing on the swivel base and is provided with the narrow type of guide bearing, special provision being made for maintaining alinement with the



Vertical Turret Lathe.

center of the table. The vertical head may be rapidly moved in all directions by power, independent of the feed works or table drive, the handles *K* throwing them in and out of the mesh. Vertical and cross motion in either direction may be engaged singly or simultaneously, the operating mechanism for each being independent of the other. A safety device prevents damage resulting from careless handling.

The side head has a vertical movement of 28 in. and a horizontal movement of 21 in., the maximum distance from the table to the underside of the cross-slide being 25 in. A quick hand movement is provided in all directions, and also a means of making fine adjustments independent of the feed works. This head is provided with a four-faced turret tool holder in which 1½-in. x 1¼-in. tool steel may be used. The feeds for both heads are positive and independent of each other, having eight changes, ranging from 1/96 to ½ in. in all directions. The changes are obtained by turning a knurled wheel, located convenient to the operator, and the amount of feed per revolution is indicated on a direct reading index plate on each feed box. The feed is engaged and disengaged, or changed from vertical to cross feed on the main head by engaging the centrally located drop worm with the worm gears, *O*, on the end of the feed rod. These same operations for the side head are governed by a plunger operated by the lever, *M*, located in the side head saddle. The graduated scales and micrometer dials are provided with adjustable observation stops which bear numbers corresponding with those on the faces of the turrets and are invaluable in the duplication of various sizes.

Hand wheels *Q* are provided instead of crank handles for tool adjustments, thus eliminating the danger of the operator being hit when the rapid power feed is applied. The wheels are free to make a partial revolution on the sleeves before becoming engaged with them, which allows a hammer action, similar to the tapping of the hand on a crank handle and thus provides a means for fine adjustment. The thread cutting attachment for the vertical head is arranged for cutting 2, 3, 4, 5, 6, 8, 10, 11½, 12, 14 and 16 threads per inch, and will be supplied if desired. The mechanism is so arranged that the power rapid traverse may be used in returning the slide and the thread cutting feed may be again engaged without splitting the thread.

Alloy steel gears are used, with the single exception of the table gear, which is of such proportions that it cannot be successfully heat treated. A special alloy having the requisite wearing qualities in an unhardened state is, however, used in this gear. All the gearing is immersed in oil and the high speed journals are bronze bushed and self-oiling. Special attention has been given to the safety of the operator in designing the machine. The counterweights and gearing are entirely encased, the latter being readily accessible to the operator. If the machine is to be driven by belt, a driving pulley 24 in. in diameter is provided. A motor may be applied, however, and should be of 10 h. p., with a constant speed not exceeding 1,200 r.p.m. The machine being self contained, no expensive foundation is required, and the bolt holes in the base are for shipping purposes only. It weighs 18,500 lbs., and its projected floor area is 85 in. by 93 in.; its maximum height is 12½ in. from the floor.

The manner in which the railway development of Indo-China, Siam, and other portions of Southeast Asia is to be realized in the immediate future is apparent from the fact that a considerable portion of the loan now being negotiated by the government of Indo-China is to be used in the construction of a system of railways connecting French China with Siam, just as the railways to the north have been connecting that country with China proper and extending into China as far as Yunnanfu. The Indo-Chinese government purposes to build a railway from Battambang to Pnompenh. From Pnompenh connection is now made with My Toh by the Mekong river, a deep stream of easy navigation, and My Toh is already connected with Saigon by rail. Later the Pnompenh-My Toh section will also be joined by a railway, thus completing the line from Saigon to Battambang. The importance to Siam lies in the fact that from Battambang the railway will be extended up to the Siamese frontier at a point only about 75 miles distant from Patriew. Siam then may, if she desires, build this small connecting link from Patriew to the frontier and thus by a comparatively small sum of money reap the benefits of through rail connection with Saigon. This section of the line will pass along a level valley requiring no expensive or difficult engineering works. The mutual advantages to be gained from this railway are apparent. Saigon will have not only connection with Bangkok, but also with Singapore and Penang (for no doubt the branch line to Penang will be built), thus shortening by several days the mail and passenger route between Saigon and Paris. Bangkok will be on a fair way to become a great railway center. With trains arriving daily from Singapore and Penang on the southern line, from Upper Siam on her northern line, and from Saigon on her eastern line, it will have unrivaled opportunities for becoming one of the great ports of the East. Singapore and Penang will also benefit by the great influx of trade and increased traffic.

General News Section.

The Cleveland, Cincinnati, Chicago & St. Louis and the Vandalia have withdrawn from the Illinois and Iowa Demurrage Bureau.

A new hospital, built by the Southern Pacific Company, and costing $200,000, was dedicated at Houston, Tex., last Saturday. The building is of brick and masonry, three stories high, with a roof of terra cotta tiling.

The Order of Railway Conductors, at its convention in Jacksonville, Fla., last week, increased the pay of its officers, making the salary of the president $8,500; that of the senior vice-president and the general secretary $5,000 each; and those of the other vice-presidents $4,500 each.

A second conference will take place on June 6 between the officers of the railways in Kansas and the members of the Public Utilities Commission of that state to discuss the commission's plan for making a valuation of the roads and the information it has asked of them. The first conference was held on May 11.

Boiler makers and certain other shop men employed by the Southern Railway and its controlled campanies, said to number 18,000 in all, after conferences with President Finley, say that they have the promise of an increase of pay amounting to two or three cents an hour. They had asked for five cents an hour and, according to the newspapers, had threatened to strike.

By an order issued by Judges Grosscup and Kohlsaat, at Chicago, to the clerk of the United States Circuit Court, all sleeping car rebate checks granted to patrons of the Pullman Company and the Great Northern Railway between July 12, 1910, and January 31, 1911, while cases involving rates of this company were pending, will be paid from the funds which were deposited with the court by these companies when the cases were tried.

The Wells, Fargo & Company Express has been formally notified by the state of Texas that unless it pays $24,000 in taxes levied against it in that state, proceedings will be instituted for the forfeiture of its charter to do business there. The company has offered the state $200 for a permit to continue to do business in the state, but refuses to pay the tax, on the ground that the fixing of that amount on its annual earnings in Texas is unconstitutional and unjust.

The Hudson & Manhattan, running trains between New York and Jersey City under the Hudson river, announces that by October 1 trains will be run through between New York and Newark, about 9 miles. The underground line is to be connected with the Pennsylvania, about one mile west of Jersey City, and the Pennsylvania tracks are to be used from that point to Manhattan Transfer, a mile east of Newark. From Manhattan Transfer an independent line will be used to reach a new station at Saybrook place, near Broad street, Newark.

The nineteenth annual report of the Texas railway commission shows that during the fiscal year ending June 30, 1910, payments for personal injuries by the railways in that state aggregated $2,360,293, or about 2.45 per cent. of the gross earnings of the roads. Of the 234 persons killed in 1909 eighty were employees, compared with 69 employees killed in 1910, while the number of persons employed increased from 57,909 in the former to 61,908 in the latter year. Although there was a decrease of 11.69 per cent. in the number of deaths and of 1.79 per cent. in the injuries, the amount paid for personal injuries was 7.76 per cent. greater in 1910 than in 1909.

In a race extending over four days, and participated in by three or more contestants, Pierre Vedrine last week flew from Paris, France, to Madrid, Spain, a distance of about 766 miles. Although stops were made, lengthening the time from start to finish, the actual time spent in motion was only 12 hours, 18 minutes, equal to more than 62 miles an hour. Vedrine won a prize of $20,000 offered by a Paris newspaper and one of $10,000 offered in Spain. In crossing the Guadarrama mountains Vedrine rose to a height of about 6,500 ft. and encountered dangerous whirlwinds; and at one time he was compelled to descend in order to avoid attacks of eagles.

The Business Men's League, of St. Louis, 800 strong, recently inspected the railway terminals of the city, the Terminal Railroad Association taking the visitors around on a special train. President McChesney, of the Terminal Railroad Association, told his guests that the heaviest month's business ever handled by the terminal was that for March, 1910, when 297,966 cars were interchanged by it, and that the heaviest day's business was on March 23, when it moved 10,567 cars. The passenger trains run to and from the union station in the year ending June 30, 1910, numbered 108,833, an average of 298 trains a day, the total being an increase over the preceding year of almost 7,600 trains. Number of passenger cars 521,266, an average of 1,538 a day.

Accident Record—Correction.

An officer of the Baltimore & Ohio writes: "I note on page 1214 of your issue of May 26, in the report of accidents, that on the Baltimore & Ohio, near Silver Run, April 27, a boiler of the engine of a passenger train exploded, killing two and injuring six. This accident was greatly exaggerated by the newspapers; the facts are that the right back parallel rod of the engine was broken while the train was running about 25 miles an hour; the broken rod knocked off the air drum and badly damaged the right side of the cab; the engineman received a severe cut under the chin and was slightly scalded on the head, but no other persons were injured."

Resignation of Colonel Dunn from the Army.

Lieutenant Colonel Beverly W. Dunn, after 32 years' service, has resigned his place in the army to devote his time wholly to the Bureau of Explosives. This resignation is due to the refusal of President Taft to reverse the action of the war department, which decided that Col. Dunn should not be permitted to retire with the pay allowed by law to retired officers who have served 30 years.

The duty Lieut.-Col. Dunn is performing as chief inspector of the Bureau for the Safe Transportation of Explosives and Other Dangerous Articles, has proved to be of unquestionable value to the general public in securing a maximum of safety in the transportation of dangerous articles upon railways and steamships. The extent of the protection needed is indicated by the fact that statistics show that, on an average, a railway passenger passes a car loaded with explosives every fifty miles of his journey. Recognition of this danger led the government in May, 1907, to detail Lieut.-Col. Dunn, then in the ordnance department, to take charge of the bureau; and this detail was renewed March 25, 1909. The expenses, amounting to over $100,000 a year, are paid by the members of the bureau (railway companies, steamship companies, express companies and manufacturers of explosives). Colonel Dunn's services are peculiarly valuable because, in order to be effective, the bureau must be so organized that its work can be continuous. New problems constantly arising can be properly met by close study of technical conditions followed by frequent conferences with all parties concerned. The work is at present in an acute situation, as the inspections made by the bureau have shown a constantly increasing number of articles to be so dangerous as to require that they be placed under its supervision as promptly as possible. The same native qualities which made Col. Dunn of value to the bureau, at the outset, also make him of value to the ordnance department, and the chief of that department has always been opposed to his present assignment. He was therefore subject to recall to the work of the ordnance department at any time. In this state of uncertainty the executive committee of the bureau, on February 7 last, endeavored to get the war department to permit Col. Dunn to retire, so that he could continue to perform the important duties for which he had been detailed without severing his official connection with the army. This application was refused and Col. Dunn was ordered to return to duty on June 1, 1911. Feeling from his knowledge and experience in the two fields of duty that the work of the chief inspector of the bureau of explosives was of much greater importance and usefulness to

the country than any future service in the ordnance department. Col. Dunn tendered his resignation from the army to take effect October 1, 1911. It has been accepted and according to custom, leave of absence allowed from June 1 to that date. He thus gives up $3,300 a year (retired officer's pay) in order to keep up without interruption his valuable service to the railways.

Pennsylvania Legislature.

The legislature of Pennsylvania, which adjourned on May 25, passed a Full Crew Bill, which is now in the hands of the governor. The bill requires a flagman and two brakemen on freight trains of over 30 cars; and on passenger trains consisting of over three passenger cars and a baggage car, a brakeman and a flagman. The same rule applies to mail and express trains of over four cars, and requires that on such trains the rear car shall have suitable heating apparatus.

The penalty for violation of this law is $100, but whether or not this would apply to a conductor, engineman or trainman is not clear. The principal sections of the law apply to any "railway company, its officers or agents . . . ." The penalty section reads "any railway company, its officers or agents, officers of the court, receiver, or any person or persons operating a railway violating, etc., . . . shall be guilty of a misdemeanor . . . ."

The bill for a public utilities commission, which was one of the governor's principal measures, was rejected. It was passed by the house by a very large majority, but in the senate it was defeated by a vote of 29 to 17; the main argument being that the committee had not had time to properly consider so important a bill. The governor hopes for a senate more in sympathy with his views at the next session, and has announced that he shall introduce his bill again at the convening of the new assembly in 1913.

An Employers' Liability Bill also passed the house by a large majority, but was killed in the senate. This bill was similar to that which has been passed in New Jersey, but went into great detail in describing the indemnities to be paid by employers to injured employees and the dependents of employees killed.

The Louisiana Health Train.

The Louisiana State Board of Health has been running a "health exhibit train" around the state, giving lectures and in other ways stimulating public opinion to demand purer food, better doctors and cleaner homes. From one of the announcements of a recent trip it appears that stops were made at prominent points on the St. Louis Southwestern, the Texas & Pacific and the Houston & Shreveport. The board of health has a car of its own and two other cars are furnished free by the management of the New Orleans & Northeastern. It appears that the special trains in all cases are hauled free by the railways. Dr. Oscar Dowling, of Shreveport, president of the board of health, gives us the following particulars of his enterprise:

The first "health train" was started November 5 last, from New Orleans for Shreveport. This train consisted of a 75-foot passenger coach with all the seats removed. In this coach there are arranged normal anatomical specimens and pathological specimens illustrating the effects of consumption. There is also a school exhibit, an oral dental hygiene exhibit and model sanitary closets; exhibits showing sanitary plumbing, a slaughter pen, a dairy, cooking apparatus, heating and ventilating systems, waste plant, and a vacuum cleaner; a department of pure food, and illustrations of the fly evil, with numerous charts. In each window of the car there is a transparent picture representing insanitary conditions as found by one of the state inspectors. There are exhibits furnished by the Anti-Tuberculosis League and the Russell Sage Foundation Fund.

The board carries two machines for illustrating lectures. In one of these moving pictures are shown illustrating "The Man Who Learned," "The Pesky Fly," "The Gymnastic Fly," and "The Red Seal." The other is devoted to subjects pertaining to general sanitation, the hookworm, etc.

In each town visited talks are given to the school children and to the public, special stress being laid on social hygiene. When the special train arrives at a town two of the force remain on the train to explain the exhibits; one goes to the schools, and two others make sanitary inspections of the dairies, markets, butcher pens, hotels, restaurants, bakeries, stores, court house, jail, and railway stations.

The state officers demand that all incorporated towns have city boards of health. Where a town is not thus organized the benefits to be derived by such an establishment are set forth.

This "health train" is to be taken to Los Angeles for the meeting of the American Medical Association, June 26. It will return via Omaha, Denver and Chicago.

Prizes to Stimulate Scientific Agriculture.

In line with the policy of the railways in the northwestern part of the United States and in Canada to arouse popular interest in the products of the American soil generally, and especially to interest farmers in the advantages of their own territory, several of the roads have offered prizes to be given in connection with the American Land and Irrigation Exposition, which will be held in New York City, November 3 to 12, next. A circular issued by the Northern Pacific outlines the purpose of the exposition and gives a list of the prizes offered.

Howard Elliott, president of the Northern Pacific, has assigned 160 acres of land, about 18 miles northwest of Terry, Mont., to be awarded by popular allotment at the exposition and also offers a prize of $500 in gold for the best 25 boxes of apples. James J. Hill, chairman of the Great Northern, offers a $1,000 prize silver cup for the best 100 lbs. of wheat grown in the United States in 1911. Sir Thomas G. Shaughnessy, president of the Canadian Pacific, offers $1,000 in gold for the best 100 lbs. of hard red, spring or winter wheat raised by any farmer in North or South America. A. J. Earling, president of the Chicago, Milwaukee & St. Paul, offers a $1,000 prize cup for the best 100 lbs. of white oats raised in the United States. A. E. Stilwell, president of the Kansas City, Mexico & Orient, offers a $1,000 cup for the best exhibit of late commercial potatoes grown in the United States in 1911.

Other prizes offered include a $1,000 cup by the International Harvester Company of America for the best corn grown in the United States; a $1,000 cup by the American Land & Irrigation Exposition, through a donation of Paul Ledyard Van Cleve, of the Sweet Grass Land & Cattle Co., of Montana, for the best alfalfa exhibit; a $1,000 cup by Horace Havemeyer for the best sugar beets; a $1,000 cup by Adolphus Busch for the best hops grown in the United States; a $1,500 cup by Col. Gustav Pabst for the best bushel of barley grown in the United States; and a $1,000 cup by Col. Robert M. Thompson for the best short-staple cotton. The circular referred to includes detailed information regarding the conditions under which the awards will be made.

A "Frisco" Line from Memphis to Baton Rouge.

The St. Louis & San Francisco has made a contract with the St. Louis Iron Mountain & Southern, by which the line of the Iron Mountain from Memphis, Tenn., southward to Baton Rouge, La., on the west side of the Mississippi, will be used as a joint line for the benefit of both companies. B. F. Yoakum, chairman of the board of directors of the St. Louis & San Francisco, says that under the contract the Iron Mountain will at once begin to improve this line, throughout its entire length of 380 miles, by laying 85-lb. rails and ballasting the track with broken stone. This line will make a direct connection between the Birmingham line of the Frisco which runs from northwest to southeast through Memphis, and its line between New Orleans, La., and Houston, Tex., which runs through Baton Rouge.

The terms of the contract provide that it shall run 90 years, during which time the St. Louis & San Francisco will use the tracks of the Iron Mountain and Texas & Pacific between Memphis and Baton Rouge, La., 380 miles. (Texas & Pacific about 100 miles of territory, to Baton Rouge.) After this track has all been relaid with 85-pound rail, the cost to the owners will be in round numbers $15,000,000. On this investment the Frisco will pay an amount equal to 2¼ per cent. per annum or approximately $337,500; and will share the maintenance on a car mileage basis after the standard rail has been laid. No new equipment has been ordered and the Frisco contemplates only the purchase of 15 or 20 steel passenger cars in the near future. Frisco had surveyed a route close to the west bank of the Mississippi parallel to this route, and, it is said, would have begun its construction had not a change come in Missouri Pacific management.

The Illinois Railway Law.

The law recently passed by the legislature of Illinois to stiffen the railway law of the state and increase the power of the Board of Railroad & Warehouse Commissioners may be comprehensively described by saying that it gives to the commissioners powers quite similar to those exercised by the Interstate Commerce Commission in federal matters. Fourteen sections of the old law are amended and retained, and seventeen new sections are added.

The chairman of the commission is to receive a salary of $6,000; each of the other commissioners $4,000; the secretary $3,500; and the commissioners may appoint other necessary employees. Passenger and freight tariffs may be filed with the commission as soon as issued. The commissioners are to investigate accidents not only when persons are killed or injured, but also in case of injury to property; and if they see fit they may make complete reports of accidents to the governor. In the examination of railway records the commissioners and other agents are to have the right to enter any car office, etc., during business hours to examine the books and affairs of the company.

Section 20, which is the first new section, gives the commission jurisdiction over all common carriers within the state, including express companies, steamboat lines, private line companies, etc. Street railways are excluded; but what to do with a road that is part street and part something else is not indicated. The term "railroad" includes bridges, power stations, terminal facilities, etc.

Section 24 makes it the duty of every common carrier to provide and furnish transportation at reasonable rates upon an order made by the commission; an order first having been given.

Section 25 is copied from section 4 of the Federal law on the Long and Short Haul section.

Section 26 requires every common carrier to furnish all reasonable, proper and equal facilities.

By section 27 the commission is empowered to establish through rates and joint classifications, but to make a through rate the commission must have found that it is necessary for the accommodation of the public and that it will not give to one carrier an unfair advantage over another. The shipper shall have the right to route his freight. The commission is empowered to make rates for demurrage, etc.; to compel physical connection and to establish switching limits and switching rates; but a car transfer from one road to another over an intermediate road shall not come within the term "switching."

Section 30 empowers the commission to inquire into the management of all common carriers, and it may make and enforce orders to secure the safety and accommodation of the public.

Section 32. After due hearing the commission must make a schedule of reasonable maximum rates for each common carrier. The commissioners may revise tariffs which they have issued. Any common carrier unlawfully neglecting or refusing to obey an order of the commission shall be liable to a fine of $500.

Section 35. Any aggrieved party may appeal to the circuit court of San Gamon county within 20 days.

Transportation and Car Accounting Officers.

The regular summer meeting of the Association of Transportation and Car Accounting Officers, which will be held at the Hotel Cape May, Cape May City, N. J., June 20-21, will be opened at 10 a. m. on Tuesday, June 20. G. P. Conard, 24 Park place, New York, is secretary.

MEETINGS AND CONVENTIONS.

The following list gives names of secretaries, dates of next or ***regular*** *meetings, and places of meeting.*

AIR BRAKE ASSOCIATION.—F. M. Nellis, 53 State St., Boston, Mass.

AMERICAN ASSOCIATION OF DEMURRAGE OFFICERS.—A. G. Thomason, Scranton, Pa.; next meeting, June 22, 1911, Niagara Falls, N. Y.

AMERICAN ASSOCIATION OF GENERAL PASSENGER AND TICKET AGENTS.—C. M. Burt, Boston, Mass.; next meeting, St. Paul, Minn., Sept. 19, 1911.

AMERICAN ASSOCIATION OF FREIGHT AGENTS.—R. O. Wells, East St. Louis, Ill.; June 20-23, Kansas City, Mo.

AMERICAN ASSOCIATION OF RAILROAD SUPERINTENDENTS.—O. G. Fetter, Carew building, Cincinnati, Ohio; 3d Friday of March and September.

AMERICAN ELECTRIC RAILWAY ASSOCIATION.—H. C. Donecker, 29 W. 39th St., New York; October 9-13, Atlantic City, N. J.

AMERICAN RAILWAY ASSOCIATION.—W. F. Allen, 24 Park Place, New York.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—C. A. Lichty, C. & N. W., Chicago; Oct. 17-19, 1911, St. Louis, Mo.

AMERICAN RAILWAY ENGINEERING ASSOCIATION.—E. H. Fritch, Monadnock Block, Chicago.

AMERICAN RAILWAY INDUSTRIAL ASSOCIATION.—G. L. Stewart, St. L. S. W. Ry., St. Louis, Mo.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—J. W. Taylor, Old Colony building, Chicago; June 14-16, 1911, Atlantic City, N. J.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—O. T. Harroun, Bloomington, Ill.; annual convention, July 11-13, Chicago.

AMERICAN SOCIETY FOR TESTING MATERIALS.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.; June 27-July 1, Atlantic City, N. J.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—C. W. Hunt, 220 W. 57th St., New York; 1st and 3d Wed., except June and August, New York.

AMERICAN SOCIETY OF ENGINEERING CONTRACTORS.—D. J. Haner, 13 Park Row, New York; 3d Tuesday of each month, New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. 39th St., New York.

ASSOCIATION OF AMERICAN RAILWAY ACCOUNTING OFFICERS.—C. G. Phillips, 143 Dearborn St., Chicago.

ASSOCIATION OF RAILWAY CLAIM AGENTS.—J. R. McSherry, C. & E. I., Chicago.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Jos. A. Andreucetti, C. & N. W. Ry., Chicago; semi-annual, June 16-17, Washington, D. C.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.—P. W. Drew, 135 Adams St., Chicago; June 19, 1911, Boston, Mass.

ASSOCIATION OF TRANSPORTATION AND CAR ACCOUNTING OFFICERS.—G. P. Conard, 24 Park Pl., New York; June 20-21, Cape May City, N. J.

CANADIAN RAILWAY CLUB.—James Powell, Grand Trunk Ry., Montreal, Que.; 1st Tuesday in month, except June, July and Aug., Montreal.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—Clement H. McLeod, 413 Dorchester St., Montreal, Que.; Thursdays, Montreal.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 841 North 50th Court, Chicago; 2d Monday in month, Chicago.

CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York; 2d Thurs. in Jan. and 2d Fri. in March, May, Sept., Nov., Buffalo, N. Y.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.—D. F. Jurgensen, 116 Winter St., St. Paul, Minn.; 2d Monday, except June, July and Aug., St. Paul.

ENGINEERS' SOCIETY OF PENNSYLVANIA.—E. R. Dasher, Box 704, Harrisburg, Pa.; 1st Monday after 2d Saturday, Harrisburg, Pa.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.—E. K. Hiles, 803 Fulton building, Pittsburgh; 1st and 3d Tuesday, Pittsburgh, Pa.

FREIGHT CLAIM ASSOCIATION.—Warren P. Taylor, Richmond, Va.; June 21, St. Paul, Minn.

GENERAL SUPERINTENDENTS' ASSOCIATION OF CHICAGO.—Wed. preceding 3d Thurs., Chicago.

INTERNATIONAL MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York.

INTERNATIONAL RAILWAY CONGRESS.—Executive Committee, rue de Louvain, 11 Brussels; 1915, Berlin.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—D. B. Sebastian, La Salle St. Station, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—L. H. Bryan, D. & I. R. Ry., Two Harbors, Minn.; July 25-27, Chicago.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—A. L. Woodworth, Lima, Ohio; annual, Aug. 15, Toledo, Ohio.

IOWA RAILWAY CLUB.—W. B. Harrison, Union Station, Des Moines, Ia.; 2d Friday in month, except July and August, Des Moines.

MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, Old Colony building, Chicago; June 19-21, 1911, Atlantic City, N. J.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION, OF UNITED STATES AND CANADA.—A. P. Dane, B. & M., Reading, Mass.; Sept. 12-15, 1911, Atlantic City, N. J.

NEW ENGLAND RAILROAD CLUB.—G. H. Frazier, 10 Oliver St., Boston, Mass.; 2d Tuesday in month, except June, July, Aug. and Sept., Boston.

NEW YORK RAILROAD CLUB.—H. D. Vought, 95 Liberty St., New York; 3d Friday in month, except June, July and August, New York.

NORTHERN RAILWAY CLUB.—C. L. Kennedy, C., M. & St. P., Duluth, Minn.; 4th Saturday, Duluth.

OMAHA RAILWAY CLUB.—H. H. Maulick, Barker Block, Omaha, Neb.; second Wednesday.

RAILROAD CLUB OF KANSAS CITY.—C. Manlove, 1008 Walnut St., Kansas City, Mo.; 3d Friday in month, Kansas City.

RAILWAY CLUB OF PITTSBURGH.—C. W. Alleman, P. & L. E., Pittsburgh, Pa.; 4th Friday in month, except June, July and August, Pittsburgh.

RAILWAY SIGNAL ASSOCIATION.—C. C. Rosenberg, Bethlehem, Pa.; June 13, New York; annual, Oct. 10, Colorado Springs, Colo.

RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, Box C, Collinwood, Ohio.

RICHMOND RAILROAD CLUB.—F. O. Robinson, Richmond, Va.; 2d Monday, except June, July and August.

ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION.—Walter E. Emery, P. & P. U. Ry., Peoria, Ill.; September 12-15, St. Louis, Mo.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo.; 2d Friday in month, except June, July and Aug., St. Louis.

SOCIETY OF RAILWAY FINANCIAL OFFICERS.—C. Nyquist, La Salle St. Station, Chicago; Sept. 12-14, St. Paul, Minn.

SOUTHERN ASSOCIATION OF CAR SERVICE OFFICERS.—E. W. Sandwich, A. & W. P. Ry., Montgomery, Ala.

SOUTHERN & SOUTHWESTERN RAILWAY CLUB.—A. J. Merrill, Grant bldg., Atlanta, Ga.; 3d Thurs., Jan., March, May, July, Sept., Nov., Atlanta.

TOLEDO TRANSPORTATION CLUB.—J. G. Macomber, Woolson Spice Co., Toledo, Ohio; 1st Saturday, Toledo.

TRAFFIC CLUB OF CHICAGO.—Guy S. McCabe, La Salle Hotel, Chicago; meetings monthly, Chicago.

TRAFFIC CLUB OF NEW YORK.—C. A. Swope, 290 Broadway, New York; last Tuesday in month, except June, July and August, New York.

TRAFFIC CLUB OF PITTSBURGH.—T. J. Walters, Oliver building, Pittsburgh, Pa.; meetings monthly, Pittsburgh.

TRAIN DESPATCHERS' ASSOCIATION OF AMERICA.—J. F. Mackie, 7042 Stewart Ave., Chicago; annual, June 20, 1911, Baltimore, Md.

TRANSPORTATION CLUB OF BUFFALO.—J. M. Sells, Buffalo; first Saturday after first Wednesday.

TRANSPORTATION CLUB OF DETROIT.—W. R. Hurley, L. S. & M. S., Detroit, Mich.; meetings monthly.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. & H. R., East Buffalo, N. Y.; annual, August 29-September 1, Chicago.

WESTERN CANADA RAILWAY CLUB.—W. H. Rosevear, P. O. Box 1707, Winnipeg, Man.; 2d Monday, except June, July and August, Winnipeg.

WESTERN RAILWAY CLUB.—J. W. Taylor, Old Colony building, Chicago; 3d Tuesday of each month, except June, July and August.

WESTERN SOCIETY OF ENGINEERS.—J. H. Warder, 1735 Monadnock Block, Chicago; 1st Wednesday in month except July and August, Chicago.

WOOD PRESERVERS' ASSOCIATION.—F. J. Angier, First National Bank bldg., Chicago.

Traffic News.

Beginning June 4, the Rock Island Line will run between Chicago and Colorado points an additional fast train, leaving Chicago daily at 6 p. m. and arriving in Denver early the following evening; eastbound it will leave Denver daily at 3.45 p. m. and arrive in Chicago early the next evening.

In accordance with announcements previously made, through passenger service from Chicago to Puget Sound over the Chicago, Milwaukee & St. Paul and the Chicago, Milwaukee & Puget Sound was inaugurated on May 28, the all-steel train, "The Olympian," leaving Chicago for the coast at 10.15 p. m., and "The Columbian" leaving Seattle for Chicago at the same time.

Sixty-five members of the wholesale merchants' board of the Chamber of Commerce of Cleveland, Ohio, last week made a trip by special train to advertise their business in 25 towns in western Pennsylvania, including Butler, Oil City and Ridgway. These three are the only places at which the train stopped over night. Other stops varied from 30 minutes to 2 hours.

It is announced that the reduced freight rates which the Delaware & Hudson and the Erie have advertised from New York to the West by way of Albany, are to be met by the New York Central, which will arrange for a boat line on the Hudson river to take freight at the lower rates, presumably the same as those offered by the Erie, the boats to deliver the freight to the New York Central at Albany.

Four hundred members of the Indiana Trade Association, Indianapolis, will visit thirty southern Indiana towns on June 19, 20 and 21, to boom their business. The party will be made up of manufacturers and jobbers and will travel on a special train made up by the Pennsylvania, consisting of six compartment sleepers, two diners and a combination baggage and day coach. All meals will be served on the train. Night meetings will be held at cities where the boomers make their longest stops. L. W. Cooper is president and LeRoy Snyder, secretary.

In the Federal Court at Boston, May 26, a number of prominent milk contractors were indicted by the grand jury for engaging in a combination in undue restraint of trade and commerce; and the New York, New Haven & Hartford Railroad Company was at the same time indicted for giving illegal rates. The shipments of milk, on which are based the charges of illegal transportation rates, were made at Willimantic, Conn., and the milk was destined to Dorchester, Mass., which is a part of Boston. The Elm Farm Milk Company is also indicted for receiving the rebates. The tariff prescribed a rate, per car load, for cars of 840 cans, and it is charged that for this particular shipper the company repeatedly carried a much larger number of cans in a car for the same price.

Traffic Club of New York.

The last meeting of the Traffic Club of New York was held at the Waldorf-Astoria on May 31. Gerrit Fort, passenger traffic manager of the Union Pacific, addressed the meeting, taking for his subject, Come West, Old Man, Come West. Robert A. Bartlett, captain of Peary's ship on the trip to the Pole, delivered a new illustrated lecture on Hunting Big Game in the Arctic.

Freight Car Balance and Performance.

Arthur Hale, chairman of the committee on relations between railways of the American Railway Association in submitting the accompanying figures showing consolidations of statistical bulletins for the calendar year 1910, and for convenience in comparison, the compilations for previous yearly periods, says:

"It is interesting to note the similarity in the performance for the years 1907 and 1910, the latter being the first year since 1907 when traffic conditions were such as to make the yearly comparisons of any value. The principal averages are shown in the following table:

	1910.	1907.	Percent Inc.	Percent Dec.
Cars owned per mile of road	9.57	9.18	4.25	....
Percent home cars on line	58.0	58.0	....	....
Percent loaded mileage	70.0	70.3	....	.43
Miles per car per day	23.7	24.0	....	1.25
Tons per loaded car	21.6	20.3	6.40	....
Ton miles per car per day	360	331	8.76	....
Earnings per car per day	$2.41	$2.45	....	1.63

"There was an increase of 4.25 per cent. in the number of cars owned per mile of road, and this, in connection with the fact that there was a larger surplus equipment in 1910 than in 1907, should be kept in mind in comparing the "per car" averages.

"The distribution of cars by groups shows quite a difference in conditions in 1910 from those obtaining in 1907. In the former year the roads showing an excess of cars in use over the number owned were principally in New England and in the West and Southwest. In 1910 the New England roads used very few cars more than their total ownership. This is due partly to a large increase in cars owned, partly to lighter traffic, and partly to equal interchange arrangements that enabled the distributing roads to relieve themselves of the excess of equipment that naturally results from the character of their traffic.

"The Pacific coast roads used fewer than their ownership, while the roads in group 6, comprising the lines in the West and Northwest, reported a considerable excess used throughout the year. It is also to be noted that the roads of the Southeast which were borrowers of cars up to and including 1907, have so materially added to their equipment that they are now creditor roads.

"For the purpose of analyzing the ownership and use of equipment as between the various sections of the country, together with the tonnage handled, the following table covering the years 1905 and 1910 has been prepared. The comparisons are expressed in percentages of the grand totals of the various items. With the exception of the 'ton miles of freight handled,' which item is taken from the Interstate Commerce Commission reports, the averages used are from the consolidated bulletins:

	Groups I-II-III-IV-V		Groups VI-VII-VIII-IX-X		Groups I-II-III	
	1910.	1905.	1910.	1905.	1910.	1905.
Mileage operated by reporting roads (percent of grand total)	40.48	42.49	51.49	48.79	23.86	26.40
Freight cars owned (percent of grand total)	62.88	62.03	32.24	33.76	46.52	48,09
Railroad cars on line (percent of grand total)	61.52	61.33	33.85	34.54	45.99	48.07
*Tons freight handled one mile (I. C. C. reports) (percent of grand total)	61.68	63.03	38.33	36.97	48.62	50.39

	Groups IV-V		Group VI		Group IX	
	1910.	1905.	1910.	1905.	1910.	1905.
Mileage operated by reporting roads (percent of grand total)	16.98	16.09	24.52	27.01	3.70	2.35
Freight cars owned (percent of grand total)	16.36	13.94	17.87	20.08	1.16	1.02
Railroad cars on line (percent of grand total)	15.53	13.26	19.29	20.03	1.38	1.07
*Tons freight handled one mile (I. C. C. reports) (percent of grand total)	13.06	12.64	18.38	18.34	3.27	2.91

*I. C. C. figures are for fiscal years ending June 30.

"It will be noted that in 1905 the roads in groups 1 to 5 (inclusive) including the territory east of the Ohio and Mississippi rivers and the states of Indiana, Ohio and Michigan, while operating 42 per cent. of the mileage reported, owned 62 per cent. and used 61.33 per cent. of all cars in service, and handled 63.03 per cent. of the total tonnage in the country. In 1910 this group of roads operated 40.84 per cent. of the mileage, owned 62.88 per cent., and used 61.52 per cent. of the cars, and handled only 61.68 per cent. of the tonnage. The increase in the per cent. of cars used was slightly less than the increase in per cent. of cars owned. An examination of the totals for groups 1, 2 and 3 and groups 4 and 5 discloses the fact that the decreases in per cent. of mileage and in tons handled were in groups 1, 2 and 3, while in groups 4 and 5 the percentage of mileage, cars owned, cars used and ton miles handled all show some increase, although the increase in the tons handled is not so great as the other items. Groups 6 to 10, inclusive, show increases in the per cent. of mileage owned and in the tonnage handled, but report decreases in the per cent. of cars owned and cars used. Group 6, which includes the largest car owners in this territory, shows a decrease in the percentage of cars owned and in mileage operated. There is also a slight decrease in the per cent. of cars used and a slight increase in the per cent. of ton miles handled. Group 9, which has apparently always been under equipped, shows an increase in the per cent. of cars owned, but somewhat greater increase in the per cent. of cars used. The per cent. of mileage operated and the per cent. of tonnage handled in this group both show increases."

FREIGHT CAR BALANCE AND PERFORMANCE.

YEAR 1905. Groups.	Roads Reporting. No.	Roads Reporting. Mileage Operated.	No. Revenue Freight Cars Owned.	Percent Ry. Cars on Line. Home.	Foreign.	Total.	Excess on Line Over Number Owned.	Percent Cars in Shop.	Av. Cars on Line Per Frt. Engine Owned.	Av. Miles Per Car Per Day.	Percent of Loaded Mileage.	Average Ton Miles. Per Car.	Per Loaded Car.	Per Car Per Day.	Average Daily Earnings. Per Car Owned.	Per Ry. Car on Line.	All Cars on Line.
*1	6	4,695	33,709	63	92	155	18,550			18.8					$3.45	$2.22	$2.14
2	18	21,978	441,227	66	30	96	.....			22.5					2.30	2.39	2.18
3	23	24,569	291,302	54	42	96	.....			24.8					2.06	2.14	2.01
4	9	14,437	83,611	67	37	104	3,062			23.8					2.26	2.18	2.12
5	15	16,829	138,432	61	27	88	.....			26.7					2.14	2.42	2.33
6	21	52,453	320,052	76	23	99	.....			26.9					2.50	2.55	2.46
7	2	3,287	15,204	58	76	134	4,197			32.3					5.37	4.05	3.62
8	11	14,927	96,393	63	33	96	.....			22.4					2.26	2.37	2.23
9	7	4,573	16,323	69	34	103	484			23.1					2.78	2.70	2.40
10	12	19,570	90,259	66	43	109	8,763			54.0					8.07	7.35	6.30
11	4	14,284	62,719	75	22	97	.....			31.6					2.68	2.78	2.50
12	2	2,649	4,313	80	22	102	127			21.0					7.71	7.51	7.40
Grand Total	131	194,251	1,593,544	66	33	99	.....	....	..	24.8	....	....	....	...	$2.47	$2.50	$2.34
YEAR 1906.																	
*1	8	7,124	53,760	67	80	147	24,289	....	..	18.9	....	....	....	...	$3.47	$2.30	$2.15
2	28	24,110	511,258	63	31	94	.....	....	..	23.9	....	....	....	...	2.30	2.48	2.28
3	28	23,660	332,785	50	42	92	.....			24.0					2.11	2.24	2.11
4	11	15,597	105,824	64	46	110	10,672			20.3					2.21	2.13	1.95
5	19	17,672	145,536	58	35	93	.....			26.0					2.31	2.54	2.43
6	26	53,068	337,317	67	30	97	.....			25.7					2.63	2.68	2.58
7	3	3,248	15,596	40	59	99	.....			47.4					5.69	5.70	5.53
8	15	20,974	110,672	57	36	93	.....			24.7					2.38	2.62	2.28
9	12	6,701	19,642	67	63	130	6,026			28.1					4.15	3.34	2.93
10	15	21,301	97,012	59	58	107	7,049			31.1					4.19	3.96	3.58
11	5	10,392	60,231	64	25	89	.....	....	..	31.4	....	....	....	...	2.39	2.70	2.55
12	5	3,511	7,441	85	28	113	866	....	..	25.8	....	....	....	...	....	....	....
Grand Total	175	207,358	1,797,074	61	37	98	.....	....	..	25.0	....	....	....	...	$2.53	$2.61	$2.44
YEAR 1907.																	
*1	6	5,569	47,187	63	80	143	29,494	2.78	102	17.2	73.7	10.5	13.8	183	$2.85	$2.16	$2.00
2	24	31,248	620,102	58	36	94	.....	5.13	69	24.2	67.8	15.4	23.1	375	2.39	2.54	2.34
3	25	18,659	305,154	53	36	89	.....	6.14	74	22.9	68.2	16.1	23.6	370	1.99	2.25	2.12
4	12	17,639	129,757	58	45	103	4,506	7.59	63	18.5	69.9	12.9	18.5	239	2.06	2.00	1.95
5	19	17,524	156,255	53	38	91	.....	4.58	67	24.5	71.6	14.3	17.8	323	2.26	2.48	2.37
6	21	53,956	361,658	66	31	97	.....	4.57	59	25.3	73.5	13.5	19.2	337	2.57	2.70	2.57
7	3	3,315	16,001	32	90	122	3,565	5.20	52	40.7	71.7	13.2	20.7	545	6.15	5.03	4.78
8	15	22,089	129,112	54	38	92	.....	7.93	54	23.4	71.0	12.3	17.5	289	2.65	2.87	2.73
9	12	7,358	22,247	53	104	157	12,776	4.81	69	23.9	67.8	10.8	15.9	259	4.42	2.79	2.63
10	18	21,993	105,467	59	63	122	23,425	5.64	64	27.4	70.2	12.9	18.4	353	4.52	3.74	3.48
11	5	13,289	77,045	63	34	97	.....	5.84	51	27.5	76.7	12.4	16.2	339	2.45	2.52	2.40
12	4	2,652	7,041	94	27	121	1,447	4.61	65	25.7	70.1	10.7	15.4	265	4.04	3.36	3.34
Grand Total	164	215,291	1,977,026	58	40	98	.....	5.47	65	24.0	70.3	14.2	20.3	331	$2.53	$2.61	$2.45
YEAR 1908.																	
*1	6	6,503	70,706	77	35	112	8,532	6.84	73	15.7	70.4	10.2	14.5	160	$2.14	$1.91	$1.85
2	26	34,675	664,379	72	23	95	.....	8.64	68	21.2	64.9	14.8	22.9	315	1.93	2.03	1.91
3	22	16,699	279,346	78	23	101	4,360	8.95	79	17.7	63.9	14.7	23.1	269	1.54	1.53	1.45
4	11	19,643	134,315	72	21	93	.....	8.55	57	19.3	66.1	12.9	19.4	248	1.72	1.86	1.82
5	19	18,638	171,287	72	22	94	.....	9.09	66	20.8	68.1	13.4	17.9	278	1.84	1.97	1.89
6	19	54,467	370,352	80	21	101	2,069	5.83	61	21.6	72.2	13.3	18.9	290	2.07	2.08	1.94
7	2	3,533	15,761	40	66	106	969	6.03	41	40.3	71.5	14.6	20.5	618	5.60	5.25	4.85
8	15	21,915	138,006	74	24	98	.....	14.60	57	19.2	67.6	13.0	19.5	249	2.19	2.22	2.11
9	12	7,669	26,165	60	70	130	7,971	5.93	54	24.0	65.6	11.4	17.3	277	3.77	2.86	2.68
10	21	23,133	113,049	57	37	94	.....	6.74	49	27.8	69.4	14.3	20.6	398	3.62	3.84	3.55
11	4	16,246	97,913	79	17	96	.....	7.71	47	24.6	73.4	13.1	17.8	320	2.08	2.18	2.09
Grand Total	157	220,521	2,081,279	74	24	98	.....	8.39	63	21.0	67.6	13.9	20.7	294	$2.06	$2.10	$1.99
YEAR 1909.																	
*1	6	6,471	74,755	71	41	112	8,600	5.57	77	16.4	72.2	10.4	14.4	169	$2.32	$2.08	$2.00
2	24	33,637	660,651	67	29	96	.....	6.64	68	23.3	66.9	15.5	23.1	360	2.19	2.29	2.15
3	20	15,104	228,893	72	28	100	.....	6.87	78	20.3	67.8	15.8	23.3	331	1.82	1.84	1.77
4	10	17,637	146,631	66	25	91	.....	8.06	54	23.0	67.3	14.5	21.6	334	2.02	2.21	2.17
5	17	18,782	173,583	67	25	92	.....	8.91	64	22.3	71.9	13.8	18.4	309	2.00	2.18	2.10
6	18	54,455	366,762	77	27	104	13,731	5.90	64	22.8	72.3	13.6	19.2	303	2.31	2.24	2.14
7	2	3,548	16,630	42	75	117	2,888	4.66	47	37.8	76.1	15.7	20.5	603	5.92	5.04	4.66
8	14	22,019	132,545	68	33	101	1,479	13.04	56	20.9	70.7	13.9	20.0	293	2.64	2.61	2.47
9	11	7,868	26,628	54	81	135	9,246	5.59	53	26.0	67.5	11.5	17.1	298	4.11	3.03	2.85
10	21	23,565	115,586	56	41	97	.....	5.74	52	29.0	71.3	14.5	20.3	419	3.95	4.08	3.81
11	4	15,949	99,119	76	19	95	.....	9.40	47	26.4	75.0	13.6	18.1	360	2.35	2.46	2.38
Grand Total	147	219,045	2,058,450	69	30	99	.....	7.13	63	23.0	69.6	14.6	21.0	335	$2.34	$2.38	$2.26
YEAR 1910.																	
*1	6	6,287	76,082	51	53	104	2,729	4.56	74	16.8	74.1	11.2	15.1	187	$2.36	$2.27	$2.19
2	24	32,279	692,089	56	41	97	.....	5.48	70	23.5	67.9	16.1	23.8	379	2.28	2.36	2.23
3	19	14,195	215,535	57	45	102	4,014	7.33	81	21.9	69.3	16.0	23.1	352	2.07	2.03	1.94
4	11	18,812	173,554	55	36	91	.....	6.58	53	24.6	67.1	15.8	23.6	389	2.15	2.37	2.32
5	19	18,699	172,240	50	35	85	.....	8.07	60	25.9	72.5	14.5	18.9	372	2.18	2.54	2.44
6	18	54,202	378,038	69	42	111	41,658	5.37	71	22.0	74.1	13.9	19.8	302	2.56	2.30	2.22
7	3	3,911	17,317	36	80	116	2,733	4.78	46	40.2	70.1	15.7	21.2	666	6.78	5.86	5.37
8	13	22,354	133,760	57	42	99	.....	9.11	57	22.2	70.0	14.3	20.8	318	2.72	2.74	2.59
9	12	8,168	24,516	65	78	143	10,500	5.34	58	26.4	67.5	12.0	17.6	317	4.08	2.93	2.74
10	19	25,152	128,203	49	46	95	.....	5.58	53	29.9	71.2	14.9	21.9	447	4.14	4.39	4.09
11	5	16,963	103,057	66	29	95	.....	6.08	46	27.5	77.9	14.4	18.4	395	2.69	2.77	2.69
Grand Total	149	221,022	2,114,391	58	41	99	.....	6.11	65	23.7	70.0	15.1	21.6	360	$2.51	$2.53	$2.41

*(1) New England. (2) N. Y., N. J., Del., Md., Eastern Pa. (3) Ohio, Ind., Mich., Western Pa. (4) Vt., W. Va., N. C., S. C. (5) Ky., Tenn., Ga., Ala., Miss. (6) Ia., Ill., Wis., Minn., Dakotas. (7) Mont., Wyo., Neb., Dakotas. (8) Mo., Ark., Kans., Colo., etc. (9) Texas, Louisiana, New Mexico. (10) Ore., Idaho, Nev., Cal., Arizona. (11) Canadian Lines. (12) Mexican Lines.

INTERSTATE COMMERCE COMMISSION.

Reparation Denied.

Anaconda Copper Mining Co. v. Chicago & Erie et al., and eight other cases. Opinion by Commissioner Meyer.

Former action not modified. (21 I. C. C., 40.)

Carter White Lead Co. v. Norfolk & Western et al. Opinion by Commissioner Clark.

Following the decision in *Stowe-Fuller Co. v. Pennsylvania Company*, 12 I. C. C., 115, maintenance rates on coke, based on the use to which coke is put, are condemned. Following the *Anaconda Copper Mining Co.* case, 21 I. C. C., 40, reparation is denied on shipments of coke to Omaha; and following the *Metropolitan Paving Brick Co.* case, 17 I. C. C., 197, reparation is denied on shipments of coke to Chicago. (21 I. C. C., 41.)

Raymond B. Scudder v. Texas & Pacific et al. Opinion by the commission:

Where two cars are shipped under one bill of lading, the car-

rier cannot compel the consignee to accept one car until the arrival of the second, and therefore cannot assess demurrage charges until it tenders the equipment required for the entire shipment covered by the bill of lading. In this case, however, complainant accepted two bills of lading for shipping two cars of sugar; therefore, the rule allowing a rate for a carload applying on the entire lot, although it may be less than two or more full carload lots, did not apply in this case. (21 I. C. C., 60.)

Complaint Dismissed.

Northwestern Leather Company v. Oregon Railroad & Navigation Company et al. Opinion by the commission:

Rates of $1.30 per 100 lbs. on dry hides and $1 per 100 lbs. on green hides, from San Francisco, Cal., and Los Angeles, to Manistique, Mich., and Sault Ste. Marie, not found to be unreasonable. (21 I. C. C. 66.)

Wright Wire Co. et al. v. Pittsburgh & Lake Erie et al. Opinion by the commission:

Rate of $3.40 per ton on iron and steel rods from Struthers, Ohio, to Palmer, Mass., and Worcester, as compared with rate of $3 from Monessen, Pa., for a longer haul over the same line in the same direction, not found to constitute a violation of section 4 of the act as it existed prior to June 18, 1910. (21 I. C. C. 64.)

Reparation Awarded.

Mountain Ice Company et al. v. Delaware, Lackawanna & Western et al. Opinion by Commissioner Prouty:

The complainants ask reparation in certain shipments of ice. The serious question in these cases is the application of the statute of limitations, and the first branch of that question, did the filing of these complaints interrupt the running of the statute?

The averments in the original complaints herein cannot be construed as the filing of claims for reparation; but the supplemental complaints, when taken in connection with the original complaints, constitute filing of claims for reparation, within the sixteenth section, sufficient to interrupt the running of the two-year period.

A complainant should state seasonably and with sufficient definiteness whether he will claim reparation, so that the commission and the defendants may be advised of the nature of the claim; but every rule of convenience and of justice requires that, having made this statement in those general terms, the matter may be held in abeyance until the main question has been decided and the parties know whether any reparation will be awarded, and if so, on what basis.

In all shipments made by the Mountain Ice Company, except those to a particular consignee, that company and not the consignee is entitled to reparation, as the ice was sold for a delivered price, and by the terms of contract of sale the freight money was to be paid by the ice company. *Nicola, Stone & Myers Co. case,* 14 I. C. C. 199. In the other cases reparation should be awarded to the consignees. (21 I. C. C. 45.)

Advanced Rates on Grain Justified.

In re the investigation of advanced rates by carriers on grain, grain products, etc. Opinion by Commissioner Clark.

These investigations were instituted by the commission under the provisions of section 15 and involve the propriety of advances in rates on wheat and coarse grain from North Dakota and South Dakota producing points to primary grain markets, such as Minneapolis, Duluth, Milwaukee, Chicago, Omaha and points taking the same rates. The C. M. & St. P., and the Chicago & North Western bore the principal burden of the defense. The proposed advances would give the Milwaukee a total increase in revenues derived from wheat of $125,764, or an average increase of 1.519 cents per 100 lbs., and on coarse grains a total of $113,834, or 1.492 cents per 100 lbs. Many of the same arguments used in the western advance rate case were used by the roads, but they also claimed that there were peculiar circumstances which differentiated this case from the western case. The commission did not attach much weight to the complications showing that neither North Dakota nor South Dakota grain contributes its proper proportion to the payment of interest and dividends. Fundamentally this statement proceeds on what the commission considered to be an erroneous theory; that is, that certain portions of the system of a railway can be segregated from the whole and the expenses and earnings be charged and credited to such portions on a mileage pro rata basis.

Here is a somewhat peculiar situation and one which perhaps differs from that in any other section of the country. The traffic from that portion of South Dakota which is involved is mainly grain. It goes to the great grain markets, Minneapolis, Chicago, Duluth and Omaha. Minneapolis and Duluth are premium wheat markets to the extent of from three to seven cents per hundred pounds, and this naturally, like a magnet, draws to them the greater volume of the grain. Within reasonable limits the amount of the rate is not so material to Minneapolis and Duluth so long as the present adjustment to Minneapolis, Duluth and Chicago is maintained. The lack of through tonnage in South Dakota affects the volume of traffic, increases the average train load, increases operating expenses, and is therefore reflected in net earnings. Canadian competition on the north holds down the North Dakota rates and is reflected to some extent in South Dakota, but South Dakota appears to contend that the full force of that competition should be accorded to South Dakota.

It has never been the view of the commission that the prosperity of a shipper, a locality or a state was a reasonable excuse for the imposition of rates conditioned on such prosperity; but when coincident with very substantial reductions in rates, the price of the commodity has nearly doubled in value and claims for loss and damage have materially increased, two of the essential factors of a reasonable rate, value and risk, have been changed in favor of the carriers' contention that the proposed advances should be allowed.

The commission is of the opinion that the carriers have sustained the burden of proof which the statute imposes on them, and that, with certain exceptions, the proposed advances to Minneapolis, Duluth, Milwaukee and Chicago are not unreasonable. The details of a general rate adjustment like this are many and they involve features of direct and cross-country competition with which the traffic officers of the defendants are more familiar than is the commission. Acting in a spirit of cordial co-operation, they probably can work out tariffs that will be more satisfactory all around than an adjustment prescribed in detail by the commission would be.

The proposed advances, however, to Omaha are unreasonable, and the commission fixes rates somewhat lower than the present rates. (21 I. C. C., 22.)

STATE COMMISSIONS.

The California State Railroad Commission has issued a formal order forbidding the sale of reduced rate tickets to students of schools and colleges, on interurban and steam railways; effective June 1. (Does not apply to city trolley lines.)

COURT NEWS.

Judgments aggregating $1,350 have been rendered against the Chicago, Indianapolis & Louisville by Judge Anderson in the Federal Court at Indianapolis, on complaints of having violated the Federal law against keeping telegraph operators on duty for more than nine hours consecutively. The complaints charged forty violations of the law. A penalty of $200 on the first paragraph of each action was imposed, and a penalty of $25 on each of the other offenses charged.

The Supreme Court of Indiana has sustained the Marion Superior Court in its decision approving an order of the State Railroad Commission, fixing a charge of $3 a car for switching freight at Bloomington. Claim had been made that rates for switching ought to be fixed on a tonnage basis and certain traders had complained that the charges at Bloomington were exorbitant. The railway company, the Chicago, Indianapolis & Louisville, had attacked the validity of the law creating the commission, arguing that the legislature, contrary to the constitution, had conferred judicial powers on the commission.

In the Federal Court at Philadelphia, May 25, a suit by the government against the Philadelphia & Reading to determine whether freight passing through this country is subject to rates prescribed by the Interstate Commerce Commission, was decided

in favor of the railway. The government contended that the railway company had agreed with a firm in Hamburg, Germany, to transport beet sugar from the initial point to its destination for a through rate of 50 cents per 100 lbs. The cargo arrived in Philadelphia and was then shipped to its destination in Canada, at an inland charge of 55 cents per 100 lbs. At the time, the published inland rate was $1.32 per 100 lbs. The prosecution hinged on the question whether the initial point of transportation was Philadelphia or in Germany. If the starting point was in this jurisdiction, then, according to the government, there had been a violation of the interstate commerce law, as the charge of the railroad was lower than the published rates. Counsel for the railway company denied this contention, and was upheld by the court, which decided that the starting point was in Germany.

The Supreme Court of the United States has sustained the hours of service law for railway employees passed by Congress in 1907. The decision was announced by Justice Hughes, in the suit instituted by the Baltimore & Ohio. The court was unanimous. Justice Hughes said that the words of the statute were plain that only interstate carriers and persons engaged in interstate commerce were affected by the statute. Because the interstate employees sometimes engage in intrastate business did not defeat the law. As to the authority of the commission to issue the order putting the law into effect, the justice said that the entire question of authority had been settled by legislation in 1910. The justice found no other objection to the order or to the law itself. The Baltimore & Ohio attacked the law as unconstitutional on the ground that it applied to intrastate as well as interstate railways and employees. The road alleged that Congress could not and did not attempt to delegate to the commission the power to require reports of violation of the law; and that the labor and expense necessary to make the reports constituted a taking of the road's property without due process of law, and therefore in violation of the Constitution; also that it compelled self-incrimination by officers and employees in violation of the Constitution. This decision affirms that of the Circuit Court for the District of Maryland.

The Commerce Court, at Washington, May 25, heard the case of the Norfolk & Western, et al., vs. The United States; concerning freight rates from Roanoke to Winston-Salem, from Lynchburg to Durham, and from Cincinnati to Winston-Salem and Durham. The hearing on the application for temporary injunction was completed and the application was taken under advisement. A hearing was given also in the case of the Atchison, Topeka & Santa Fe et al., vs. United States; known as the "Pre-icing case," a suit to set aside an order of Interstate Commerce Commission reducing from $30 to $7.50 per car the charge for refrigeration of citrous fruits where such fruits are pre-cooled and pre-iced by the shipper. Mr. Lamb concluded his argument for the interveners and Mr. Robert Dunlap concluded for the petitioner. The case was taken under advisement.

On May 26 the court took up the case of the Omaha & Council Bluffs Street Railway Co., and the Omaha & Council Bluffs Railway & Bridge Co., vs. Interstate Commerce Commission; involving an order of the Commission dated November 27, 1909, reducing from fifteen cents to ten cents per passenger the fare between Council Bluffs, Ia., and Omaha, Neb. An order temporarily restaining the commission from enforcing its order was granted by the United States Circuit Court for the District of Nebraska in April, 1910. The case was heard on the demurrer of the Interstate Commerce Commission and the motion of the United States to dissolve the restraining order and injunction issued by the circuit court. The case was taken under advisement by the court. At the close of the arguments in this case the court adjourned until the first Monday in October.

In the Federal court at New Orleans, May 17, F. M. Durselin and C. H. George were convicted of conspiracy to defraud, and of using the mails for frudulent purposes, in connection with shipments of lumber to Germany. As announced in the newspapers the charge was that the defendants shipped lumber of one grade and forwarded bills of lading calling for a higher grade; but from a correspondent who is acquainted with the facts we learn that to class this as a "bill-of-lading fraud" would be an error. The facts in the case are these: the shippers, Durselin & George, bought a number of cars of lumber from various lumber mills and consigned the freight to themselves at New Orleans. The railway companies in billing the cars simply showed them to contain pine lumber. After the cars had reached New Orleans, Durselin & George sold them to Laurao Petersen, of Hamburg, Germany. The lumber was shipped from New Orleans by vessel and was billed to order, notify Petersen, at Hamburg. The ocean bill of lading issued by the steamship company described the shipments as pitch pine lumber, whereas the specifications which accompanied the invoice and bill-of-lading described the lumber as heart rift pitch pine flooring and heart face pitch pine flooring. There was considerable difference between this description and the lumber which was actually shipped; so that in fact, the shippers received one-third more money from the consignee at Hamburg than what the lumber was really worth. The failure of consignee to wait until the freight was received before paying the draft is explained by the statement that he had full confidence in the shippers. A steamship will frequently issue a bill-of-lading for a certain consignment, and hand it to the shipper, who in turn mails it at once to consignee. It is carried by the U. S. mail to New York and thence by steamer to Germany, and arrives at destination perhaps a week ahead of the goods. Shipments are frequently shut out by one steamer and taken by another steamer of the same line at a later date. Petersen had done considerable business with this firm for two years prior to this transaction and had never had any occasion to question the quality of the goods shipped; so, in this case, he did not wait until the shipment arrived, but immediately took up the draft. When the shipment reached destination, the lumber did not come up to specifications and invoice and the matter was taken up by him with the shippers. They made no reply to his communication, and finally he came to America and made a demand for his money. It appears that the shippers were in financial straits about that time and could not make restitution and the matter was placed in the hands of the Federal authorities, who had the men indicted and tried, and they were sentenced to one year in the Federal penitentiary at Atlanta, Ga.

American Tobacco Company Ordered Dissolved.

The Supreme court of the United States on Monday last issued a decision, similar to that of two weeks earlier in the case of the Standard Oil Company, holding the American Tobacco Company to be an illegal monopoly and combination in restraint of trade. The decision, like the former one, was by Chief Justice White, and the court was unanimous; but Mr. Justice Harlan dissented, as before, from the reasoning of the majority in regard to the application of the "rule of reason" to the interpretation of the Anti-Trust law. Justice Harlan especially condemns the delegation to the lower court of discretion to ascertain whether new conditions cannot be created, in harmony with the law. The decision differs from that in the Standard Oil case in that the disintegration of the trust must be carried out under the direction of the lower court, the acts of the several constituent tobacco companies to be reported to the court for approval. For this work a period of six months is allowed, this to be extended to eight months if the court shall find such extension necessary. On this point the decision says:

" . . . That the court below, in order to give effective force to our decree in this regard, be directed to hear the parties, by evidence or otherwise, as it may be deemed proper, for the purpose of ascertaining and determining upon some plan or method of dissolving the combination and of recreating out of the elements now composing it a new condition which shall be honestly in harmony with and not repugnant to the law.

"That for the accomplishment of these purposes, taking in view the difficulty of the situation, a period of six months is allowed from the receipt of our mandate, with leave, however, in the event, in the judgment of the court below, the necessities of the situation require, to extend such period to a further time, not to exceed sixty days.

"That in the event, before the expiration of the period thus fixed, a condition of disintegration in harmony with the law is not brought out, either as the consequence of the action of the court in determining an issue of the subject, or in accepting a plan agreed upon, it shall be the duty of the court, either by way of an injunction restraining the movement of the products of the combination in the channels of interstate or foreign commerce, or by the appointment of a receiver, to give effect to the requirements of the statute. . . ."

REVENUES AND EXPENSES OF RAILWAYS.

MONTH OF MARCH, 1911. (SEE ALSO ISSUES MAY 12 AND 19.)

Name of road.	Mileage operated at end of period.	Operating revenues			Operating expenses						Net operating revenue (or deficit).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or dec.) comp. with last year.
					Maintenance										
		Freight.	Passenger.	Total, inc. misc.	Way and structures.	Of equipment.	Traffic.	Trans-portation.	General.	Total.					
Alabama & Vicksburg	143	$98,539	$33,622	$143,359	$24,705	$22,184	$4,332	$49,096	$6,130	$106,447	$36,912	$219	$4,681	$32,450	—$10,257
Ann Arbor	301	113,104	32,575	154,799	12,577	23,425	4,109	56,860	6,782	103,753	51,046	—2,535	14,265	34,246	—2,957
Arizona Eastern	364[1]	103,131	34,479	145,729	61,009	12,065	1,851	37,079	2,869	114,873	30,856	25	6,943	23,938	—78,943
Atlantic & St. Lawrence	167	105,901	23,121	142,889	14,625	22,823	4,719	79,342	3,885	125,394	17,495	.....	8,452	9,043	—21,508
Buffalo & Susquehanna *R. R.*	265	160,792	8,441	174,653	27,991	32,012	1,606	66,328	6,115	134,052	40,601	.....	2,600	38,001	—
Buffalo & Susquehanna *Ry.*	91	35,288	6,759	44,102	5,390	30,164	442	20,806	2,123	58,925	—14,823	31	1,400	—16,192	—
Carolina, Clinchfield & Ohio	236[2]	135,238	10,212	148,300	13,090	18,559	6,151	31,201	8,125	77,126	71,174	.....	5,500	65,674	28,485
Carolina, Clinchfield & Ohio of S. C.	18	8,789	1,386	10,308	670	77	886	2,072	490	4,195	6,113	.....	200	5,913	—
Charleston & Western Carolina	341	156,414	25,252	190,709	29,842	21,004	2,993	63,414	4,162	121,415	69,294	.....	4,475	64,819	95
Chicago, Peoria & St. Louis	255	117,996	20,709	145,166	18,070	30,590	7,114	63,928	6,420	126,122	19,044	.....	4,500	14,544	—7,381
Colorado Midland	338	97,033	19,647	125,506	21,918	34,322	5,440	66,478	5,179	133,337	—7,891	—1,101	8,500	—17,432	—22,785
Detroit, Grand Haven & Milwaukee	190	116,913	34,174	170,779	16,872	30,345	7,056	98,337	4,613	157,223	13,556	—34	3,009	10,513	—46,578
Detroit, Toledo & Ironton	441	96,080	11,075	123,465	30,341	5,588	2,605	63,306	5,995	107,835	15,630	.....	6,712	8,918	9,106
Duluth & Iron Range	191[3]	131,675	29,117	170,370	45,951	43,943	556	80,037	10,932	181,419	—11,049	—4,348	6,717	—22,114	41,692
Duluth, Missabe & Northern	316[4]	91,994	37,775	134,489	72,807	83,055	1,983	85,847	11,818	255,510	—121,021	—1,770	5,478	—128,269	—48,150
Georgia Southern & Florida	395	123,175	61,991	209,997	21,317	39,870	5,799	83,841	8,684	159,511	50,486	.....	9,157	41,329	14,768
Grand Trunk Western	347[5]	395,589	113,546	542,316	54,996	90,308	18,756	243,078	12,302	419,440	122,876	—1,632	31,697	89,547	—58,974
Gulf & Ship Island	307	136,142	29,393	176,580	23,068	30,483	1,258	51,565	8,369	114,743	61,837	.....	5,165	56,672	—8,066
Louisiana & Arkansas	255	113,459	14,359	132,508	19,451	17,735	2,193	34,779	4,649	78,807	53,701	.....	2,825	50,876	2,006
Louisiana Ry. & Nav. Co	350	107,987	18,027	134,243	19,077	20,060	4,747	53,445	5,853	103,182	31,061	.....	4,400	26,661	—295
Louisiana Western	207	117,607	59,520	185,386	17,952	23,190	6,859	55,420	7,561	110,982	74,404	749	6,577	68,576	28,970
Midland Valley	324	78,301	36,291	121,408	21,511	18,657	2,430	34,841	6,413	83,852	37,556	2,757	5,475	34,838	—16,228
Kansas City, Mexico & Orient	740	109,526	29,077	146,598	32,405	34,300	8,315	71,623	7,964	154,607	—8,009	.....	6,750	—14,759	—17,073
Minneapolis, St. Paul & S. S. Marie	3,764[6]	1,258,165	347,877	1,718,857	181,818	268,079	51,859	709,361	44,376	1,255,493	463,364	—2,952	96,373	364,039	—357,193
New Orleans Great Northern	282	114,999	28,514	154,313	22,955	20,810	3,097	47,317	6,773	100,952	53,361	—66	1,890	51,405	—1,163
Northwestern Pacific	376	90,499	108,330	221,277	51,781	46,880	3,173	95,445	9,678	206,957	14,320	.....	12,700	1,620	—24,553
Northern Central	469	859,809	168,682	1,081,368	162,512	192,240	14,060	516,801	28,702	914,315	167,053	103	36,740	130,416	—23,713
St. Joseph & Grand Island	319	92,156	34,018	137,575	21,013	21,952	6,392	60,195	6,735	116,287	21,288	61	5,711	15,638	57,145
San Antonio & Aransas Pass	727	178,016	72,599	269,537	88,231	49,192	5,129	131,151	11,297	285,000	—15,463	.....	11,000	—26,463	—72,017
Santa Fe, Prescott & Phoenix	364[7]	97,602	37,506	148,716	25,506	16,990	2,863	39,135	5,857	90,351	58,366	.....	103	58,262	—3,104
Tennessee Central	294	99,152	27,237	132,708	19,189	12,592	5,406	42,623	8,166	87,976	44,732	.....	3,980	40,752	26,352
Texas & New Orleans	458	239,817	90,286	348,906	64,636	69,285	7,748	131,830	10,354	283,853	65,053	1,125	12,257	53,921	—24,721
Trinity & Brazos Valley	463	96,687	29,433	131,628	27,917	24,260	9,052	74,073	11,008	146,310	—14,682	.....	3,500	—18,182	—16,763
Vicksburg, Shreveport & Pacific	171	68,023	37,440	118,492	22,858	20,287	2,939	37,876	4,665	88,625	29,867	—132	6,418	23,317	4,560
Western Maryland	543	493,452	58,329	575,701	55,695	69,024	7,338	189,527	13,083	334,667	241,034	39	21,000	220,073	—66,578
Western Ry. of Alabama	133	73,735	36,849	120,553	30,193	18,187	5,239	34,232	7,846	95,697	24,856	—117	4,339	20,400	—9,088
NINE MONTHS OF FISCAL YEAR, 1911.															
Alabama & Vicksburg	143	$887,553	$378,852	$1,368,913	$185,673	$225,946	$33,973	$459,246	$49,004	$953,842	$415,071	$411	$42,107	$373,375	—$1,500
Ann Arbor	301	1,007,466	371,768	1,471,069	177,189	182,521	35,679	503,901	65,057	964,347	506,722	—1,557	125,996	379,169	50,871
Arizona Eastern	364[1]	853,408	297,978	1,231,999	284,980	110,736	17,292	342,328	34,501	789,837	442,162	—54	55,819	386,289	—101,019
Atlantic & St. Lawrence	167	732,397	222,996	1,054,242	208,999	199,744	37,884	550,712	30,663	1,028,002	26,240	.....	76,071	—49,831	—282,969
Buffalo & Susquehanna *R. R.*	265	1,122,950	73,461	1,247,266	239,616	244,754	15,337	457,459	48,837	1,006,003	241,263	.....	21,471	219,792	—
Buffalo & Susquehanna *Ry.*	91	416,453	85,960	524,814	61,873	258,281	6,661	221,249	25,570	574,034	—49,219	29	14,529	—63,719	—
Carolina, Clinchfield & Ohio	236[2]	1,098,560	119,307	1,251,409	118,680	172,447	50,087	274,374	74,798	690,386	561,023	1,983	49,500	513,506	266,139
Carolina, Clinchfield & Ohio of S. C.	18	62,059	13,387	77,640	5,488	664	8,327	20,572	4,818	39,869	37,771	.....	1,800	35,971	—
Charleston & Western Carolina	341	1,139,927	275,303	1,480,690	260,321	171,061	28,016	493,133	34,768	987,299	493,391	.....	40,275	453,116	128,472
Chicago, Peoria & St. Louis	255	1,052,317	235,565	1,352,653	198,410	288,500	65,352	612,128	53,001	1,217,391	135,262	.....	40,500	94,762	—138,882
Colorado Midland	338	1,077,081	254,420	1,500,040	197,957	325,800	45,126	664,968	50,390	1,284,241	215,799	—5,005	74,882	135,912	—114,542
Detroit, Grand Haven & Milwaukee	190	902,084	419,173	1,531,522	207,663	203,408	57,928	778,479	41,060	1,288,538	242,984	—340	27,081	215,563	—187,851
Detroit, Toledo & Ironton	441	1,175,073	126,399	1,419,548	289,484	205,544	24,953	754,744	51,103	1,325,828	93,720	—73	60,408	33,239	11,117
Duluth & Iron Range	191[3]	5,212,014	237,541	5,536,170	579,560	502,881	4,383	1,249,864	115,518	2,452,206	3,083,964	3 132	270,069	2,817,027	—1,143,120
Duluth, Missabe & Northern	316[4]	7,454,961	358,310	7,870,356	883,622	841,179	15,382	1,281,956	130,214	3,152,353	4,718,003	45,744	394,747	4,369,000	—1,560,056
Georgia Southern & Florida	395	1,004,549	605,575	1,847,912	198,211	371,238	54,265	691,139	80,713	1,395,566	452,346	.....	84,475	367,871	—2,705
Grand Trunk Western	347[5]	2,948,881	1,427,379	4,681,168	462,495	691,533	163,892	2,025,339	116,836	3,460,095	1,221,073	—11,172	285,276	924,625	—277,168
Gulf & Ship Island	307	1,108,400	311,632	1,524,856	188,817	266,413	14,503	436,327	71,665	977,725	547,131	.....	44,924	502,207	50,810
Louisiana & Arkansas	255	910,993	143,379	1,095,932	173,479	150,810	21,791	292,365	40,478	678,923	417,009	.....	24,275	392,784	49,309
Louisiana Ry. & Nav. Co	350	989,021	180,965	1,278,512	217,211	157,091	44,275	524,347	55,020	997,944	280,568	.....	39,600	240,968	73,505
Louisiana Western	207	1,013,650	505,836	1,593,634	202,395	223,275	57,196	471,424	67,846	1,022,136	571,498	800	63,103	509,195	—17,878
Midland Valley	324	639,069	308,700	1,005,512	183,110	154,788	19,845	292,893	63,773	714,409	291,103	11,488	49,280	253,311	—22,481
Kansas City, Mexico & Orient	740	1,052,086	327,607	1,460,709	287,053	298,422	70,523	668,470	70,470	1,394,938	65,771	.....	45,612	20,159	—61,578
Minneapolis, St. Paul & S. S. Marie	3,764[6]	11,651,880	3,719,584	16,442,908	1,681,006	2,346,754	393,047	6,191,362	371,641	10,983,810	5,459,098	86,857	904,165	4,641,790	—2,471,961
New Orleans Great Northern	282	885,872	279,437	1,270,066	188,793	175,388	27,653	364,479	47,198	803,511	466,555	—824	17,510	448,221	63,565
Northwestern Pacific	376	1,052,841	1,246,842	2,492,124	451,465	373,641	25,959	943,596	83,314	1,877,975	614,149	.....	97,300	516,849	—65,934
Northern Central	469	7,373,469	1,725,937	9,657,827	1,672,251	1,839,291	149,867	4,557,923	227,865	8,447,197	1,210,630	5,110	297,613	918,127	—951,766
St. Joseph & Grand Island	319	848,127	348,107	1,302,068	269,503	184,097	58,414	563,710	56,660	1,132,384	169,684	349	53,324	116,709	24,638
San Antonio & Aransas Pass	727	2,244,792	840,628	3,269,538	631,758	429,716	45,188	1,181,131	90,936	2,378,729	890,809	.....	89,000	801,809	—44,255
Santa Fe, Prescott & Phoenix	364[7]	857,567	325,476	1,267,107	222,881	118,994	25,363	391,308	51,118	809,664	457,443	.....	947	456,496	—31,395
Tennessee Central	294	770,744	295,756	1,130,713	161,432	118,653	43,997	251,707	72,960	748,749	381,964	.....	35,821	346,143	40,839
Texas & New Orleans	458	2,005,774	813,604	2,992,877	532,246	520,586	65,458	1,179,355	86,955	2,384,600	608,277	5,296	110,768	502,805	—177,206
Trinity & Brazos Valley	463	1,269,386	288,429	1,630,228	293,751	266,099	72,977	734,715	100,451	1,467,993	152,235	.....	32,685	119,550	4,862
Vicksburg, Shreveport & Pacific	171	685,403	376,542	1,155,950	181,396	191,613	29,881	350,202	41,089	794,181	361,769	.....	53,618	307,424	59,228
Western Maryland	543	4,424,348	745,076	5,396,847	605,832	644,534	81,822	1,874,391	119,940	3,326,519	2,070,328	—2,813	177,000	1,890,515	—
Western Ry. of Alabama	133	568,644	349,799	1,000,274	191,099	168,636	46,317	268,221	52,838	727,111	273,163	—1,783	39,052	232,327	6,041

Mileage operated on March 31, 1910.—[1] 312 miles; [2] 225 miles; [3] 168 miles; [4] 293 miles; [5] 336 miles; [6] 3,533 miles; [7] 257 miles. — indicates deficits, losses and decreases.

Equipment and Supplies.

LOCOMOTIVE BUILDING.

THE WICHITA FALLS ROUTE has ordered 4 freight locomotives and 1 passenger locomotive from the Baldwin Locomotive Works. These locomotives will be used on the Wichita Falls & Northwestern.

THE GUELPH RADIAL, Guelph, Ont., has ordered one 27-ton locomotive with four No. 101-B-2 railway motors and type K-28-B control from the Westinghouse Electric & Manufacturing Company.

THE NEW YORK, NEW HAVEN & HARTFORD, mentioned in an unconfirmed item in the *Railway Age Gazette* of May 26 as having ordered 15 electric locomotives from the Westinghouse Electric & Manufacturing Company, has ordered 15 electric switching locomotives from this company.

CAR BUILDING.

THE MIDLAND VALLEY has ordered 5 passenger cars from the American Car & Foundry Company.

THE ISTHMIAN CANAL COMMISSION is in the market for a number of gasolene passenger cars. Circulars No. 634.

THE E. R. & R. G. HUTCHINS COMPANY, Chicago, is in the market for 3 forty-ton flat cars for the Booth-Kelley Lumber Company.

THE WABASH-PITTSBURG TERMINAL is said to be figuring on specifications for 500 all-steel hopper cars. This item is not confirmed.

THE MISSOURI, KANSAS & TEXAS, mentioned in the *Railway Age Gazette* of May 26 as being in the market for 17 refrigerator cars, 39 gondola cars, 34 flat cars and 18 caboose cars, has ordered this equipment from the American Car & Foundry Company.

THE PENNSYLVANIA, mentioned in the *Railway Age Gazette* of May 12 as being in the market for 41 coaches and 20 baggage cars, has ordered this equipment. The Pressed Steel Car Company will build the coaches and the American Car & Foundry Company will build the baggage cars.

THE CANADIAN PACIFIC, mentioned in the *Railway Age Gazette* of May 12 as being in the market for 1,500 box cars and 400 gondola cars, has ordered 500 box cars and 400 gondola cars from the Pressed Steel Car Company and 500 box cars from the American Car & Foundry Company.

IRON AND STEEL.

THE CLEVELAND SHORT LINE has ordered 1,000 tons of girder rails from the Lorain Steel Company.

THE WABASH PITTSBURG TERMINAL has ordered 500 tons of rails from the Carnegie Steel Company.

THE HARRIMAN LINES have ordered 12,000 tons of bridge material from the American Bridge Company.

THE COLUMBUS RAILWAY & LIGHT COMPANY, Columbus, Ohio, has placed an order for 1,100 tons of girder rails with the Lorain Steel Company.

THE CHICAGO & NORTH WESTERN has ordered 7,400 tons of bridge material from the American Bridge Company and 650 tons from the Cambria Steel Company.

THE BUFFALO, ROCHESTER & PITTSBURGH has ordered 400 tons of bridge steel from the Lackawanna Bridge Company and 160 tons of bridge steel from the American Bridge Company.

GENERAL CONDITIONS IN STEEL.—The price reductions made last week by the Republic Iron & Steel Company were more than met on Monday by the Steel Corporation, its subsidiaries and nearly all the steel manufacturers of the country, when they reduced prices on steel products, exclusive of rails, wire and tin plate. The new prices are f. o. b. Pittsburgh and became effective June 1 for shipment prior to October 1. Since the reduction last week, orders, instead of increasing, have fallen off nearly 50 per cent. The outcome is extremely problematical. The new schedule of prices is lower than that of 1909.

Supply Trade News.

Ambrose L. O'Shea has been made a director of the Gold Car Heating & Lighting Company, New York, succeeding W. W. Butler.

The Isthmian Canal Commission will receive bids until June 22 on miscellaneous supplies, including cargo-handling and locomotive cranes, electric cable and cable terminals. Circular No. 634.

The W. F. Bossert Manufacturing Company, Utica, N. Y., has completed an order to equip the Susquehanna division of the Erie with 27 triplelock switch stands. This stand was adopted after a rigid test for several months.

The Greenlee Brothers Company has removed its general sales offices from Chicago to Rockford, Ill., where the factory and accounting departments are located. The Chicago office is in charge of James A. Lounsburg, the vice-president.

J. J. Ross has been made manager of the western railway department of the U. S. Metal & Manufacturing Company, New York, with office in Chicago. Mr. Ross was formerly connected with the Featherstone Foundry & Machine Company, Chicago, and also with J. V. Dowling & Company.

The Nova Scotia Car Works, Halifax, N. S., has been organized to take over the business of the Silliker Car Company, which is now out of existence. Sufficient new capital has been added to the business to make extensions to the plant and provide adequate working capital. The capacity of the plant, when extensions are completed, will be 20 cars per day.

The Sprague Electric Company, New York, will, on June 1, be merged with the General Electric Company, Schenectady, N. Y. The manufacture and sale of the lines of apparatus and supplies heretofore handled by the Sprague Electric Company will be continued by the Sprague Electric Works of the General Electric Company under the same organization, with D. C. Durland in charge as general manager. All correspondence should be sent to the Sprague Electric Works at the same New York address as in the past.

The Baldwin Locomotive Works, Philadelphia, Pa., laid off about 1,200 men on May 27 because of a scarcity of work. Unless business improves more men will be let out. Alba B. Johnson of the company said: "Up to this time we have been turning out about forty locomotives a week, but for the next two weeks will be making only thirty a week. If business falls off we will find it necessary to reduce further our working force. If there is a substantial increase of business the men already laid off will be taken back."

The General Electric Company, Schenectady, N. Y., has received the following orders from the Omaha & Council Bluffs Street Railway Company, Omaha, Neb.: Three 1,000 kw. 600-v. rotary converters; two 1,050 kw. 3-phase transformers; three 350 kw. single phase transformers; 20 double motor GE-80 car equipments; 5 double motor GE-201 car equipments, and 5 straight air brake equipments with CP-27 compressors. Two of the 1,000 kw. rotary converter equipments will be installed in the new South Omaha substation, while the third is for installation in the power plant.

The Falls Hollow Staybolt Company, Cuyahoga Falls, Ohio, has recently shipped a carload of Falls hollow staybolt iron to the Buenos Ayres Great Southern, Buenos Ayres, Argentina. This company has also recently furnished a large quantity of its Falls hollow staybolt iron to the Cordoba Central, Rosario, Argentina; the Northern Railway of Limon, Costa Rica; the American Railroad Company, Porto Rico; the Guayaquil & Quito, Guayaquil, Equador, and the Guantanamo & Western, Guantanamo, Cuba. The company has orders on hand for shipment to the Central of Peru, Lima, Peru; the Salvador Railway, La Union, Salvador, and the Guatemala Central, Guatemala. An order is expected from the Korean Railway, Korea, for a carload of Falls hollow and staybolt iron.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently received an order from the Toledo Railway & Light Company, for 100 type 310 C, box-frame, interpole, street railway motors. This company has also received

an order from the New York, New Haven & Hartford for four quadruple equipments of No. 409 alternating current railway motors with unit switch control, and one from the Takaski Water Power Electric Company, Japan, for two double equipments of No. 12A street railway motors with type 210D controllers. The latter order was placed through Takata & Company, the Westinghouse company's representatives in Japan. The company has also received orders from the Hummelstown & Campbellstown Street Railway, the Nashville Railway & Light Company, the Cumberland Electric Railway Company, the Frederick Railroad Company, and the Connecticut Company.

TRADE PUBLICATIONS.

Ditching Machinery.—The F. C. Austin Drainage Excavator Company, Chicago, has devoted a small illustrated booklet to the advantages of its ditching machinery.

Sewer Excavators.—The Municipal Engineering & Contracting Company, Chicago, describes and discusses the Chicago sewer excavator in a newly published booklet. Illustrations and tables are included.

Northern Pacific.—This company has published a small booklet entitled Lewiston-Clarkston and the Clearwater Country, Idaho-Washington, enumerating the many products and resources of this fertile country. A great deal of information is included regarding the climate, topography and the general advantages of this region.

Woodworking Machinery.—Greenlee Bros. & Company, Rockford, Ill., have published an unusually full, cloth bound 200-page catalog on railway car shop wood-working machinery and tools. This catalog is made up of separate circulars illustrating and describing each particular machine or tool, and these circulars will be superseded from time to time by new ones.

Car Lighting.—The Gould Coupler Company, New York, has published bulletin 11 A, on the Gould simplex system of electric light for railway cars, and bulletin 11 B on the installation, operation and maintenance of this system. The first bulletin describes and illustrates this system of car lighting and the second gives full instructions, including photographs and diagrams, for the installation and operation of the system.

Tachometers.—Schuchardt & Schutte, New York, have bublished a folder describing their No. 4 tachometer, calling attention to its value for increasing general shop production. This indicator will give the revolutions per minute or, by using the measuring disc, periphery speeds in feet per minute at a glance without the aid of a stop watch. It is constructed on the principle of the circular pendulum and is encased in a shell of aluminum alloy. One, three or four ranges of speeds can be provided as desired, the four ranges registering from 100 to 12,000 r.p.m.

Southern Railway.—The industrial department of this company has just issued its pamphlet describing the agricultural and commercial resources of Virginia. This is one of the series of pamphlets being issued by the Southern Railway, each describing the resources of one of the southeastern states. Although the fruits are "delicious" and the sheep grazing "splendid," the pamphlets describe conditions in a rather more scientific way than many publications issued by the traffic department of railways, and the pamphlet describing Virginia contains a considerable fund of valuable information in regard to topography and soils, horticulture, truck raising, and the timber and mineral products of the state.

The Germans who are building the northern section of the railway from Tientsin, China, to Nanking, have completed about 290 miles of it, leaving about 125 miles of their part of the line to be built. The line runs across the great flood plain of the Hoang-ho, where stone and gravel are rare, and all along the line at short intervals are brick kilns, the product of which is used not only for masonry constructions, but for ballasting the road bed. The embankments have in many places suffered from the gales of wind, which frequently have made breaches in them. Protection is now sought by plantations of willows and locust trees. Last December 82 German engineers were employed on this work.

Railway Officers.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Samuel M. Perry has been elected secretary and treasurer of the Denver, Northwestern & Pacific, with office at Denver, Colo.

J. J. Bernet, general superintendent of the Lake Shore & Michigan Southern, at Cleveland, Ohio, has been appointed assistant to the vice-president of the New York Central Lines, with office at Chicago.

J. G. Drew, who has been appointed general auditor of the Missouri Pacific, with office at St. Louis, Mo., as was previously announced in these columns, was born February 12, 1864, at Hammondsport, N. Y. He began work in January, 1881, as a station clerk for the St. Joseph & Western, now the St. Joseph & Grand Island, at Seneca, Kan. He was then consecutively, telegraph operator, agent, superintendent's chief clerk, general manager's chief clerk, general bookkeeper and chief clerk to the auditor, and for seven and one-half years from January, 1892, was auditor of the same road. In June, 1899, he was appointed assistant comptroller of the Great Northern, and three years later was promoted to comptroller, which office he resigns to become general auditor of the Missouri Pacific.

Col. David C. Dodge, formerly for a number of years connected with the Denver & Rio Grande and the Rio Grande Western, has been elected vice-president and general manager of the Denver, Northwestern & Pacific, with office at Denver, Colo. Mr. Dodge was born at Shirley, Mass., November 17, 1837. He began railway work in 1853 and was connected with engineering and construction work on different roads in Illinois and Wisconsin until 1857. He then entered the traffic department of the Chicago & North Western, and in 1872 went with the Denver & Rio Grande as traffic manager. He was afterwards promoted to general superintendent and to general manager. He was general manager of the Denver & Rio Grande Western and its successor, the Rio Grande Western, for 15 years from 1886, and during part of that time was also vice-president and general manager of the Mexican National. He was also first vice-president of the Colorado Midland for a year from July, 1900.

Frank S. Gannon, formerly president of the Norfolk & Southern, has opened an office at 2 Rector street, New York City, and will devote himself to technical work in examinations and appraisals of railway properties and as advisory counsel. Mr. Gannon was born at Spring Valley, N. Y., and began railway work in November, 1868, as a telegraph operator on the Delaware division of the Erie Railroad. He later served on the New Jersey Midland, now a part of the New York, Susquehanna & Western; the Long Island Railroad; the Baltimore & Ohio; the New York City & Northern, now a part of the New York Central & Hudson River, and the Staten Island Rapid Transit Railroad. In January, 1897, Mr. Gannon was elected third vice-president and general manager of the Southern Railway, and from March, 1902 to November of the same year he was third vice-president of the same road. In May, 1903, he was elected vice-president of the New York City Railway, and between 1905 and 1909 he was vice-president of the Atlantic & North Carolina and president of its successor, the Norfolk & Southern, now the Norfolk Southern.

Operating Officers.

N. G. Pearsall has been appointed superintendent of the Louisiana division of the Texas & Pacific, with offices at New Orleans, La., succeeding Page Harris, promoted.

Donald Brice, roadmaster of the Duluth, Rainy Lake & Winnipeg, has been appointed assistant superintendent in charge of maintenance of way, bridges and water service.

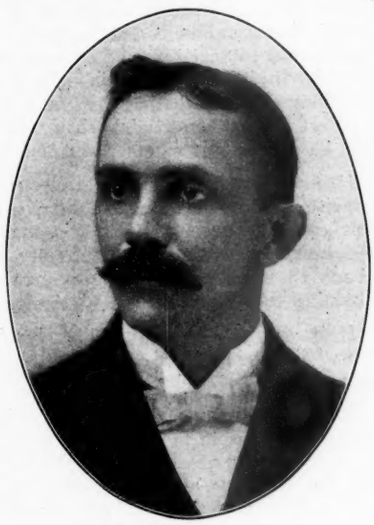
Frank P. Brown, agent of the Pullman Company at Galveston, Tex., has been appointed district superintendent, with office at San Antonio, Tex., succeeding O. S. Newell, retired.

C. D. Fisher, superintendent of District No. 3 of the Canadian Northern at Dauphin, Man., has been appointed superintendent

of District No. 5, with office at Saskatoon, Sask., succeeding J. Irwin, transferred to District No. 3 in place of Mr. Fisher.

T. A. Forbes, assistant superintendent of the dining and sleeping car department of the Great Northern at St. Paul, Minn., has been appointed superintendent of the dining and sleeping car department, with office at St. Paul, succeeding George L. Bonney, resigned. John Lambert succeeds Mr. Forbes, with office at Seattle, Wash., and the position of agent, dining and sleeping cars at Seattle is abolished.

John W. Everman, whose appointment as general superintendent of the Texas & Pacific, with office at Dallas, Tex., has been announced in these columns, was born in New York City on February 1, 1861. He graduated from the public schools of Philadelphia in 1876, and began railway work in 1879 in the ticket department of the Pennsylvania Railroad. In January, 1880, he went with the Texas & Pacific, since which time he has been in the continuous service of that company. He held various positions until May, 1892, when he was appointed assistant general superintendent, and was promoted to assistant general manager in April, 1894, which latter office he held until his recent appointment to the new position of general superintendent.



J. W. Everman.

J. W. Mulhern, whose appointment as general superintendent of the Denver & Rio Grande, with office at Salt Lake City, Utah, has been announced in these columns, was born November 25, 1863, at Naples, Ill. He received a common school education and began railway work in 1881 with the Chicago, Burlington & Quincy as a track laborer. He was then promoted consecutively to brakeman, freight conductor and passenger conductor on the St. Louis division of the Burlington, to trainmaster on the Hannibal & St. Joseph, now part of the Burlington, and in December, 1902, was appointed superintendent of terminals at Kansas City, Mo. Two years later he was made superintendent of the Hannibal division and had charge of the heavy transportation incident to the World's Fair at St. Louis in 1904. From December, 1905, to July, 1908, he was superintendent of the Galesburg division, and on the latter date was appointed superintendent of the Illinois lines of the Chicago & Alton, which office he held until he was made assistant to the second vice-president and general manager of the Western Pacific in May, 1910. A month later he was appointed superintendent of the Western division, with office at Sacramento, Cal., which office he resigns to become general superintendent of the Denver & Rio Grande.

Traffic Officers.

C. T. Chapman, traffic manager of the Toledo & Western, with office at Toledo, Ohio, has resigned to accept service elsewhere.

W. F. Rothwell has been appointed general agent of the Rock Island Lines, with office at Milwaukee, Wis., succeeding William A. Hughes, deceased.

C. A. Solly, depot and ticket agent of the Chicago, Milwaukee & Puget Sound at Tacoma, Wash., has been appointed commercial agent, with office at Victoria, B. C., a new office.

F. E. Landmeier, traveling passenger agent of the Chesapeake & Ohio at Kansas City, Mo., has been appointed western passenger agent, with office at St. Louis, Mo., succeeding E. B. Pope, deceased.

C. F. Norton, traveling freight agent of the Trinity & Brazos Valley at Dallas, Tex., has been appointed general agent, with office at Corsicana, Tex., succeeding B. H. Stephens, resigned to go into other business.

C. O. Sullivan has been appointed traffic manager of the Western Ohio, with office at Lima, Ohio, succeeding C. C. Collins, resigned to accept a similar position with the Lehigh Valley Transit Company at Allentown, Pa.

L. A. Casey, traveling freight agent of the San Pedro, Los Angeles & Salt Lake, at Los Angeles, Cal., has been appointed district freight and passenger agent, with office at San Francisco, succeeding L. A. Bell, resigned.

J. E. Woodfin, soliciting freight agent of the St. Louis Southwestern at Gilmer, Tex., has been appointed general agent of the Denver & Rio Grande, with office at Fort Worth, Tex., in charge of Texas, Oklahoma and Arkansas territory.

W. E. Creamer, general agent of the Wabash at St. Joseph, Mo., has been appointed westbound agent, with office at Kansas City, Mo. R. V. Miller, contracting agent at St. Louis, Mo., succeeds Mr. Creamer, and J. H. Wack, secretary to the general freight agent at St. Louis, succeeds Mr. Miller.

J. W. Hunter, division freight agent of the Southern Railway at Selma, Ala., has been appointed an assistant general freight agent, with office at Mobile, Ala., a new office. J. B. Erwin, commercial agent at Mobile, succeeds Mr. Hunter, and R. M. Kendrick, soliciting agent at Mobile, succeeds Mr. Erwin, with office at Mobile.

H. W. Koch has been appointed commercial agent of the Minneapolis & St. Louis and the Iowa Central, with office at St. Louis, Mo., succeeding Raymond Kelly, resigned to engage in other business. This corrects the statement made in our issue of April 28, page 1,015, that W. M. Hardin had succeeded Mr. Kelly. J. S. Bock has been appointed a traveling freight agent at St. Louis.

Engineering and Rolling Stock Officers.

J. M. Kerwin has been appointed roundhouse foreman of the Rock Island Lines at Silvis, Ill., succeeding T. Kilpatrick, promoted.

E. J. Pearson, chief engineer of the Chicago, Milwaukee & Puget Sound, the Tacoma Eastern, the Milwaukee Terminal and the Idaho & Western, with office at Seattle, Wash., having resigned to become vice-president of the Missouri Pacific; C. F. Loweth, chief engineer of the Chicago, Milwaukee & St. Paul at Chicago, has been appointed also consulting engineer, with office at Chicago, and E. O. Reeder, assistant chief engineer of the St. Paul at Chicago, has been appointed chief engineer, with office at Seattle, Wash., of the four roads mentioned above. A photograph of Mr. Loweth and a sketch of his railway career were published in the *Railway Age Gazette* of December 9, 1910, page 1129, at the time of his promotion to chief engineer of the Chicago, Milwaukee & St. Paul.

E. G. Stradling, whose appointment as signal engineer of the Chicago, Indianapolis & Louisville, with office at Lafayette, Ind., has been announced in these columns, was born at Indianapolis, Ind., on September 5, 1880. He received his preparatory education in his native city and graduated as a mechanical engineer from Purdue University in 1905. He has been connected with the engineering department of the Baltimore & Ohio Southwestern and the St. Louis, Iron Mountain & Southern, and was for a time employed with the General Railway Signal Company. He also spent some time in the signal department of the Illinois Central, and for two years from 1906 was signal foreman on the installation of block signals for the Union Pacific. He was then appointed signal inspector of the Chicago, Indianapolis & Louisville, from which position he is now promoted as above.

OBITUARY.

Charles A. Wright, president of the Keweenaw Central, and a prominent financier and mining man, died at Hancock, Mich., on May 17. Mr. Wright was the chief promoter and one of the builders of the Copper Range Railroad.

In January last work was commenced on the electric line from Antofagasta, Chile, to Mejillones. The railway will run along the coast for a distance of 56 miles.

Railway Construction.

New Incorporations, Surveys, Etc.

Akron, Canton & Youngstown.—Plans have been made to build from Akron, Ohio, southeast to Mogadore over part of the route of the old projected line from Akron, via Canton to Youngstown. H. B. Stewart, president, Canton.

Atchison, Topeka & Santa Fe Coast Lines.—According to press reports, a branch is to be built from Berry Station, Ariz., which is six miles east of Kingman, to the foot of Stockton Hill, about eight miles. The line is to be built to carry ore from the mines. It is expected that S. E. Bright, San Bernardino, Cal., will carry out the grading work.

Bakersfield & Ventura.—See Ventura County (Electric).

Bamberg, Ehrhardt & Walterboro.—An officer writes that a contract has been let to the Ajax Construction Company, of which James A. Williams is president, Bamberg, S. C., to build from Bamberg to Ehrhardt, 14 miles. There will be two wooden trestles over streams and a swamp. It is proposed to extend the line from Bamberg to either Denmark, seven miles, or Jennings siding, four miles. The line is being built to carry merchandise, coal, cotton, etc. J. A. Wyman, president, Bamberg, and F. W. Frederick, chief engineer, Orangeburg. (May 26, p. 1222.)

Canadian Northern, Ontario.—Contracts have been let, it is said, to complete the 250-mile Toronto-Ottawa line, as follows: To J. P. Mullarkey, Montreal, Que., for the section between Mile 164 and Mile 180, and between Mile 200 and Mile 250. He will also do the track laying and ballasting on the 20-mile section between Mile 180 and Mile 200, for which contract for the grading and timber work has been let to Ewan Mackenzie, Toronto, Ont. A contract has also been let to A. Sinclair, Toronto, to complete the section between Toronto and Belleville. (May 26, p. 1222.)

Chicago, Rock Island & Pacific.—According to press reports, surveys are now being made for a branch from Walco, Ark., one mile south of Malvern, to which place a spur has already been built south through a lumber belt, to Caruder. This line is to be about 50 miles long, and it is understood, will eventually be extended south to Eldorado or to some point on the Crossett line.

An officer writes that the contract for building under the name of the St. Paul & Kansas City Short Line, from Carlisle, Iowa, south to Allerton, has been let to the McArthur Brothers Company, Chicago. (April 14, p. 924.)

Citrus Southern (Electric).—An officer writes that as soon as a permanent survey is made bids will be asked to build from Kissimmee, Fla., and St. Cloud, in Osceola county, north via Conway, Orlando, Winter Park, Maitland, Altamonte Springs, Longwood and Lake Mary to Sanford, in Orange county about 50 miles. The plans call for putting up a dock at Sanford, also one at Kissimmee. The company expects to use gasolene-electric cars. T. K. Miller, president, Orlando.

Clear Lake Railroad.—Incorporated in California with $500,000 capital and office at Lakeport, Cal., to build from the Northwestern Pacific, at a point near Hopland, east to Lakeport on Clear Lake, with branches from Lakeport north to Upper Lake and south to Kelseyville, in all about 30 miles. The directors include: L. H. Boggs, Kelseyville; S. E. Brooks, Hopeland; C. M. Hammon, Upper Lake; M. S. Sayre, H. V. Keeling and M. M. Gopcevic, Lakeport.

Colorado Interurban Railway.—An officer writes that this company was organized to build an electric line from Denver, Colo., north via Derby and Brighton to Fort Lupton, 27 miles, thence north via Platteville, La Salle and Evans to Greeley, with a branch from Fort Lupton, northwest to Longmont, thence to Estes Park. It is proposed to eventually build an extension from Longmont, north via Loveland to Fort Collins. The right-of-way will be 60 ft. wide throughout the entire main line, and on the branch to Longmont, most of which has been secured. Contracts have not yet been let for the work. Irving Hale, president, First National Bank building, Denver.

Copper River & Northwestern.—According to press reports, surveys are to be made at once for an extension from Mile 191 to the White river country, Alaska, about 60 miles.

Dermott, Selma & Northern.—Incorporated in Arkansas, to build from Dermott, Ark., to Selma, 15 miles. The incorporators include: L. A. Smith, A. Eirener, W. H. Roane and R. Maxwell.

El Paso, Mountain Park & Oklahoma Central.—See Oklahoma Pacific.

Eureka & Palisade.—This narrow gage line, now in operation from Palisade, Nev., south to Eureka, 84 miles, it is said, will be made standard gage.

Hudson Bay Railway.—According to press reports, bids have been asked for building a section of 180 miles of the line projected from La Pas, Keewatin, north to Hudson Bay. It is expected that contracts for other sections will be let in July. Surveys for the first 250 miles have been made. It has not yet been definitely decided whether the line will be built to Fort Churchill or Port Nelson, on Hudson bay. It is expected that the work will be started this summer and finished during 1914.

Hudson River & Eastern (Electric)—The New York Public Service Commission, Second district, has granted permission to this company to build from Sherman Park, N. Y., via Mount Pleasant and North Castle to White Plains, Westchester county, about 18 miles. The company can now build the line from Ossining to White Plains. (May 26, p. 1222.)

Hugo & Northwestern.—The chamber of commerce of Hugo, Okla., is interested in this company, which proposes to build from Hugo, via Atoka to Lehigh.

Idaho Northern Railway.—An officer is quoted as saying that an extension is to be built during the next two years, from the present terminus at Emmett, Idaho, through Long valley to the Payette lakes, about 100 miles. Bids have already been asked for work on a section of about 28 miles from Emmett, northwest.

Kansas City, Mexico & Orient.—An officer writes that a grading contract has been let to Roach & Stansell, Memphis, Tenn., for work on the section from Mertzon, Tex., southwest via Fort Stockton, to Alpine, 196 miles. (May 26, p. 1223.)

Kittitas Electric.—This company has been granted a franchise to build from Roslyn, Wash., southeast to Cle Elum. The line is to be extended southeast and a terminal point established at Ellenburg or at Kittitas. Paul L. Richards, Ellensburg, is interested. (See Washington Roads, May 5, p. 1085.)

Minneapolis, St. Paul & Sault Ste. Marie.—According to press reports, a large force of men are at work on the line from Frederick, Wis., north to Duluth, Minn., Foley, Welch & Stewart, St. Paul, is the contractor. It is expected to have the line ready for operation this coming fall. Track is now being laid on the bridge over the St. Croix river on the cut-off from New Richmond, Wis., west to Withrow, Minn. It is expected that the bridge will be opened about June 1. The St. Croix river bridge is part of the plan of straightening the Chicago division or old Wisconsin Central line, on which much work was done last year. The cut-off will shorten the line into Minneapolis by 12 miles, and passing over the St. Croix river at a height of 190 ft. will make an easy grade and avoid the high grades over which the Wisconsin Central operated. (April 21, p. 970.)

Mississippi Roads.—Members of the chamber of commerce of Natchez, Miss., are interested in a movement to have the Louisiana & Arkansas build from Jena, La., to Natchez, Miss., also to have the Southern Railway & Navigation Co. complete its line from Jeffris, Concordia parish, La., to Natchez, Miss.

Nevada-California-Oregon.—An officer writes that work is now under way by McLean & Francisco and Lloyd C. Wisemon, both of Alturas, Cal., building a 13-mile extension from Alturas, via Davis Creek and New Pine Creek, Ore., to Lakeview. (May 5, p. 1085.)

Oklahoma Pacific.—This is the new name of the El Paso, Mountain Park & Oklahoma Central, organized in 1903. The new company is to have a capital of $6,000,000, and proposes to build from a point west of Cheyenne, Okla., east to Oklahoma City, about 275 miles, with a branch from the main line south to the Texas border, in Comanche county. B. K. Kelly, president, Mountain Park; G. M. Hohl, vice-president, Hobart.

L. K. Rhodyback and A. Osborne, Mountain Park, and Sam Bretch, Hobart, are directors.

PACIFIC ELECTRIC.—A contract is said to have been let by this company to Robert Sherer & Co., Los Angeles, Cal., for building an extension from Glendale, Cal., northwest to Burbank, about five miles. It is expected that the work will be finished within 60 days.

PINE BROOK (Electric).—It is understood that a line is to be built from Caldwell, N. J., west to Fox Hill. Connection is to be made with the Public Service Railway Company at Caldwell and with the Morris County Traction Company at the western terminus. The company has a capital of $110,000. Surveys are to be started at once. A. Dallas is said to be interested in the project.

QUINCY & TERRE HAUTE (Electric).—An officer writes that this company expects to let contracts in about two months for work from Quincy, Ill., southeast to Pittsfield, 56 miles. This is the first section of the line which has been surveyed to Taylorville. The plans also include putting up some station buildings and repair shops. The line is being built to carry live stock, grain and dairy products. William C. Fick, president, Quincy.

ST. LOUIS IRON MOUNTAIN & SOUTHERN.—See an item under General News, regarding this company.

ST. PAUL & KANSAS CITY SHORT LINE.—See Chicago, Rock Island & Pacific.

SAN PEDRO, LOS ANGELES & SALT LAKE.—According to press reports, this company, now building from Moapa, Nev., southeast to St. Thomas, will build an extension northeast up the Virgin river to St. George, Utah. (May 12, p. 1133.)

SOUTHERN PACIFIC.—An officer writes that a grading contract has been given to the Utah Construction Company for double-tracking work from Lucin, Utah, west to Montello, Nev., 18 miles.

SYRACUSE, WATERTOWN & ST. LAWRENCE.—This company has asked the New York Public Service Commission, Second district, for a certificate of convenience and necessity, and for authority to exercise franchises granted to it. The company proposes to build a line from a connection with the Syracuse & South Bay Electric, in Cicero, Onondaga county, N. Y., to Brewerton, 6.33 miles. The authorized capital stock of the company is $1,250,000, and the estimated cost of building the line is $300,000. C. D. Beebe and William Nottingham, Syracuse, are interested.

VENTURA COUNTY (Electric).—An officer writes that this company will operate a line from Oxnard, Cal., south to Hueneme, with several small branches, and will take over the property of the Bakersfield & Ventura. The plans call for building extensions, aggregating about six miles. R. Oxnard, president, San Francisco.

WASHINGTON ROADS (Electric).—Bids have been asked for building a line, it is said, from Oxbow, Wash., near Seattle, to Lake Burien. W. H. Coughlin, Seattle, is interested.

WAUKEGAN, ROCKFORD & ELGIN TRACTION COMPANY.—An officer writes that this company was incorporated in Illinois with $1,500,000 capital, to build from Waukegan, Ill., west via the Fox Lake district, McHenry, Woodstock and Belvidere to Rockford, about 70 miles. Also, to build from Elgin, through the Lake district of Lake county to the Illinois-Wisconsin state line, where connection is to be made with a Wisconsin corporation, which is to extend through Twin Lakes, Wis., Powers Lake and Lake Geneva. Work is nearing completion on the first section of 15 miles. P. Ryan, Janesville, Wis., is the contractor. Charles H. Patten, president, Palatine, Ill., and H. J. Farmer, chief engineer, Waukegan.

WESTERN KENTUCKY (Electric).—This company is being organized to build about 215 miles of railway lines, from Owensboro, Ky., south and southeast of that place. The work will include putting up a bridge over the Ohio river from Owensboro to Rockport, Indiana. E. J. Noonan, chief engineer, and E. F. Wheaton is fiscal agent, 204 Owensboro Banking Co. building, Owensboro.

WILLAMETTE VALLEY & COAST.—An officer writes that this company proposes to build from Patten, Ore., one mile north of the Washington-Yamhill county line, west for six miles to Cherry Grove. Grading is now under way by Boynton, Church & McCoy, Portland, and it is expected that two miles of track will be laid by July 1. Maximum grades will be 1 per cent. and maximum curvature 3 degrees. The line is being built to carry lumber, farm products and fruit, and will use steam as the motive power, which may later be changed to electricity. A. Lovegren, president, 330 Railway Exchange, Portland, and M. E. Reed, chief engineer, Portland.

RAILWAY STRUCTURES.

BEECH GROVE, IND.—Work on two additional roundhouses at the Cleveland, Cincinnati, Chicago & St. Louis shops at Beech Grove is to be started this week. After all the improvements at Beech Grove are finished there will be 90 tracks between the shops and the main tracks.

CENTERVILLE, IOWA.—The Chicago, Burlington & Quincy is taking bids on a passenger station of brick construction, with tile floors, slate roof, hot water heat and hardwood finish. The estimated cost is $25,000.

CENTRALIA, WASH.—The Oregon-Washington Railroad & Navigation Co., the Great Northern and the Northern Pacific have approved plans, it is said, for the construction of a passenger station, freight sheds, repair shops and a roundhouse at Centralia.

EDMONTON, ALB.—A contract has been given to Phelan & Shirley for grading the approach to the Canadian Pacific high level bridge from the Strathcona side. The contract calls for the removal of about 58,000 cu. yds. of earth.

KISSIMMEE, FLA.—See Citrus Southern under Railway Construction.

LETHBRIDGE, ALB.—Bids have been received for an overhead bridge at Lethbridge, for the Canadian Pacific. There will be a 350-ft. steel span, two 60-ft. steel girders and a 450-ft. timber approach.

MACON, GA.—The Macon, Dublin & Savannah will build a pressed brick office building and passenger station.

OTTAWA, ONT.—The Grand Trunk will build new steel coal chutes, with a bunker capacity of 350 tons, to cost about $15,000.

PENSACOLA, FLA.—An officer of the Louisville & Nashville writes that contracts have been given to the American Bridge Co. for furnishing the superstructures, and to the Foster-Creighton-Gould Co., Nashville, Tenn., for erecting the same, in connection with the reconstruction of the bridges over the Choctawhatchee and Apalachicola rivers, on the Pensacola division.

PORT ARTHUR, ONT.—The Canadian Pacific will let contracts in a short time for the erection of water tanks to operate by gravity, the water supply being drawn from the small lakes in the vicinity.

REGINA, CAN.—The Canadian Pacific and the Canadian Northern will build a union station 316 ft. by 62 ft. The main building will be three stories high with a one-story annex on either side.

SACRAMENTO, CAL.—The Western Pacific has given a contract to Hyde, Hayes & Co., San Francisco, it is said, for a new 215-ft. dock at Sacramento.

SANFORD, FLA.—See Citrus Southern under Railway Construction.

SWEETWATER, TEX.—The Atchison, Topeka & Santa Fe will build a passenger station to cost about $25,000.

TORONTO, ONT.—The Dominion railway board has decided that a bridge is to be built at the junction of King and Queen streets in Sunnyside, to abolish the present grade crossing. The cost of the improvement, including land damages, will be about $175,000.

TROY, ALA.—The Atlantic Coast Line, it is said, will build a new freight house at Troy.

Railway Financial News.

Atchison, Topeka & Santa Fe.—See Garden City, Gulf & Northern.

Chicago, Burlington & Quincy.—See Great Northern.

Chicago, Milwaukee & Puget Sound.—Stockholders have voted to authorize an increase in the capital stock from $100,000,000 to $200,000,000. This additional stock will not be issued, and will be authorized only, in order to comply with the laws of Montana, which require that the capital stock of any corporation shall be equal to the amount of its authorized bonds. The Puget Sound has $200,000,000 bonds authorized, of which about $123,000,000 are issued. Recently Kuhn, Loeb & Co., and the National City Bank, both of New York, offered $25,000,000 of these bonds, and the company at the time agreed that during the present calendar year no further bonds would be sold in the market.

Denison, Bonham & New Orleans.—A press despatch says that all of the outstanding securities of this company have been sold by the Southern Railway Construction Co., of Denison, Tex., to E. D. Steger. The road runs from a point on the Missouri, Kansas & Texas, five miles southeast of Denison, to Bonham, 24 miles.

Denver, Northwestern & Pacific.—Colonel D. C. Dodge, John F. Campion and Charles Boettcher have been elected additional directors. It is said that subscriptions are being successfully raised for a fund to take care of the $11,000,000 construction company notes on which the principal is overdue.

Garden City, Gulf & Northern.—A press despatch from Topeka, Kan., says that this property has been sold to the Atchison, Topeka & Santa Fe. The road runs from Garden City, Kan., to Scott City, 40 miles.

Great Northern.—This company has filed a mortgage securing $600,000,000 bonds. Mr. Hill's explanation of the new arrangement follows:

"The Great Northern Railway, as of date May 1, 1911, has executed its first and refunding mortgage, securing a total authorized issue of $600,000,000 bonds.

"The size of the mortgage is explained by the fact that the outstanding obligations of the company, which are to be refunded, amount approximately to $330,000,000. Included, however, in the figures last named is the direct and contingent obligation of the company in the Burlington joint 4s, maturing in 1921, and aggregating $222,400,000. Covering a future of fifty years, approximately $270,000,000 in bonds therefore will be available for general corporate purposes and double tracking and additional mileage. Since its beginning thirty-two years ago the Great Northern has expended between $350,000,000 and $400,000,000 out of capital and earnings. The provision made for the future in consideration of the rapidly growing territory which Great Northern lines serve would seem intelligently conservative. In no other part of the country has nature more generously bestowed those three great sources of all national wealth—the farm, the forest and the mine—and nowhere else is there more room for such development as follows the occupation of a new country by an intelligent population.

"The railway company evidently has made ample financial provision to enable it to keep its facilities and extensions equal to all demands that a rapidly growing country may make upon it and at the same time to maintain the highest and most efficient standard of service. Future issuance of bonds against property acquired is safeguarded by the restrictions usually found in mortgages of this kind."

"I am getting old and will quit the railway business after a while. I want to leave the road in good financial shape, so it can make all the improvements needed," is the way Mr. Hill summed up his reasons for making the mortgage.

Hudson Companies.—It is announced that Harvey Fisk & Sons, New York, have sold in London sufficient Hudson & Manhattan first mortgage 4½ per cent. bonds to complete all the work in progress, including the connection with the Pennsylvania Railroad for joint service to Newark, and to pay the $2,817,500 notes due October 15, 1911.

Lake Erie & Pittsburgh.—The company has received permission from the secretary of state of Ohio to increase its capital stock from $100,000 to $6,000,000. The road is 27 miles long.

Michigan Central.—J. P. Morgan & Co., the First National Bank and the National City Bank, all of New York, are offering $16,00,000 Detroit River Tunnel 4½ per cent. bonds of 1911-1961, guaranteed principal and interest by the Michigan Central, at 102, yielding about 4.40 per cent. interest on the investment. The bonds will be secured by a first mortgage on the Detroit river tunnels and approaches, on the terminal property in Detroit and on the union station now being built in Detroit.

New York, New Haven & Hartford.—The Rhode Island company, a subsidiary of the N. Y. N. H. & H., has leased for 999 years the Providence & Danielson (electric) and the Sea View Railway (electric).

Oregon Short Line.—This company has taken over the following branch lines in Idaho and Wyoming, aggregating 315 miles: Yellowstone Railroad, 70 miles; St. Anthony Railroad, 53 miles; Salmon River Railroad, 86 miles; Wyoming Western, 23 miles; Minidoka & Southwestern, 74 miles; Boise City Railway & Terminal, eight miles.

See also Oregon-Washington Railroad & Navigation.

Oregon-Washington Railroad & Navigation.—The Union Pacific has sold to Kuhn, Loeb & Co., New York, and Baring Brothers & Co., Ltd., London, $25,000,000 first and refunding mortgage 4 per cent. bonds of the Oregon-Washington Railroad & Navigation, guaranteed unconditionally principal and interest by the Union Pacific. The bankers are offering these bonds at 93. The mortgage securing these bonds is to be a first lien on about 567 miles of railway owned, on undivided interests in about 67 miles of railway jointly owned, and on trackage rights on about 139 miles, while on about 1,133 miles of railway owned it will be subject only to the $23,380,000 Oregon Railroad & Navigation Company 4 Per Cent. Consolidated Mortgage Gold Bonds, which are not to be extended, and for the refunding of which an equal amount of the new bonds is to be reserved.

In addition to the $25,000,000 bonds sold to Kuhn, Loeb & Co., the Union Pacific has in its treasury $15,000,000 Oregon-Washington Railroad & Navigation first and refunding 4 per cent. bonds.

Pennsylvania Railroad.—In the application to list on the New York Stock Exchange the $41,261,600 stock representing the 10 per cent. allotment made to shareholders, the company says that $15,237,500 was used to pay maturing obligations and the balance for substantial additions, betterments and improvements to the property.

St. Louis & San Francisco.—See an item in regard to trackage rights in General News.

St. Louis, Iron Mountain & Southern.—See an item in regard to trackage rights in General News.

South Side Elevated.—Directors of the four Chicago elevated roads, the South Side Elevated Railroad, the Metropolitan West Side Elevated Railway, the Northwestern Elevated Railroad and the Chicago & Oak Park Elevated Railroad, have agreed to a plan by which all the roads and the union loop will be merged under the control of Blair & Co., New York, June 15 being the date set for the transfer.

Texas Central.—The company has arranged to register $798,000 first mortgage 5 per cent. bonds, due April 1, 1923, secured on the extension from Leon to Gross Plains, 41 miles.

Union Pacific.—See Oregon-Washington Railroad & Navigation Co.

Western Maryland.—This company has sold to a syndicate headed by Blair & Co., New York, $4,100,000 first mortgage 4 per cent. bonds. The proceeds are to be used to pay $3,250,000 West Virginia Central & Pittsburgh 6 per cent. bonds, due July 1, 1911, and $650,000 Piedmont & Cumberland first mortgage 5 per cent. bonds, due August 1, 1911.

Worcester, Nashua & Rochester.—Stockholders are to vote on June 6 on the question of selling the franchises and rights of this company, whose property has been leased by the Boston & Maine since 1886, to the B. & M. The majority stock was bought by the B. & M. in 1910 from the New York Life Insurance Co., for $160 per share, and it is understood that the B. & M. now owns about 80 per cent. of the outstanding $3,099,800 stock.